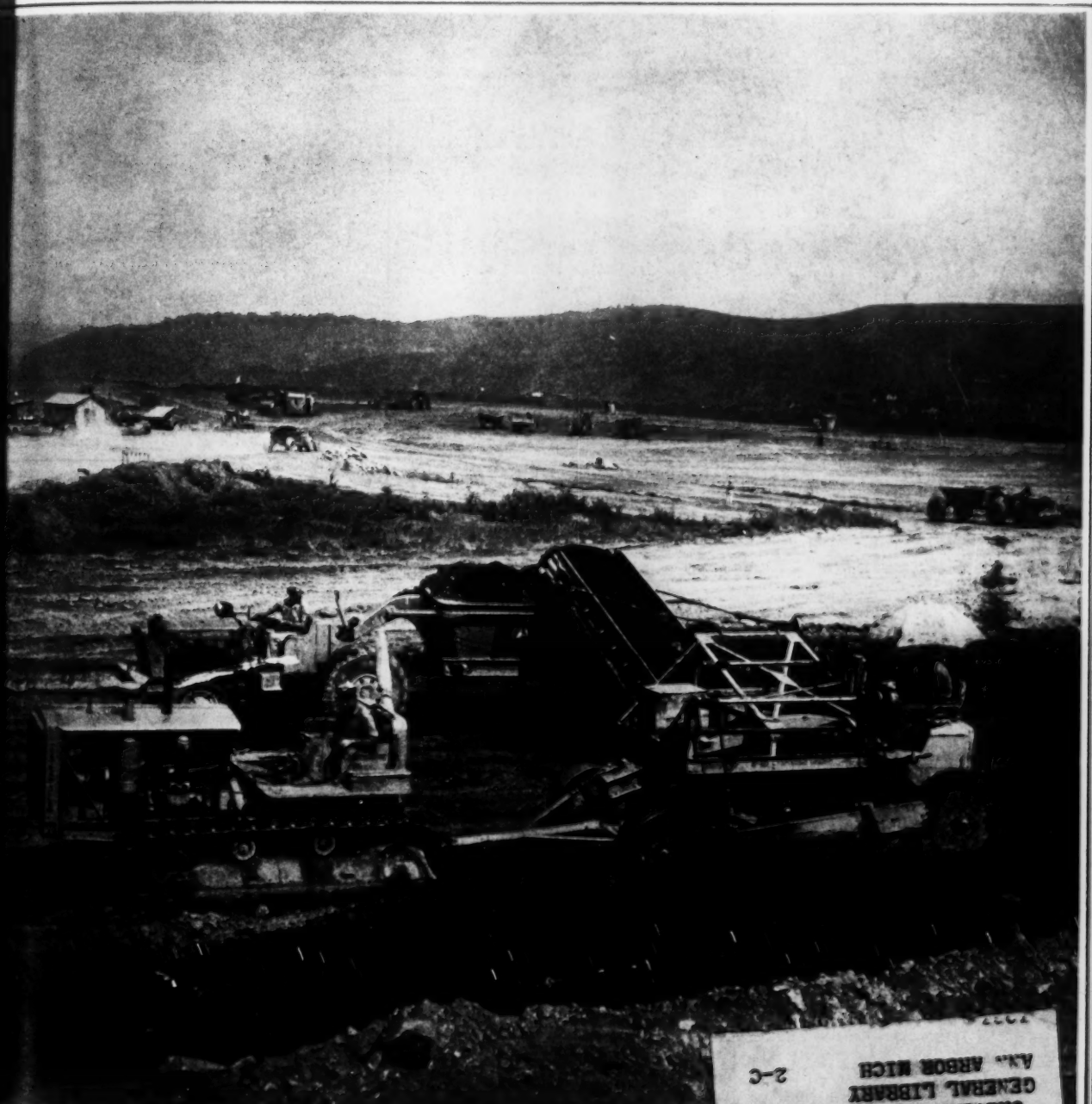
E ENGINEERING CONSTRUCTION WEEKLY · BRIDGES · IRRIGATION · FLOOD CONTROL · FOUNDATIONS · DAMS ·

RAW-HILL PUBLISHING COMPANY, INC. · TWENTY-FIVE CENTS, FIVE DOLLARS PER YEAR

NOV 1 8 1937

Engineering NEWS-RECORD

November 11, 1937



UNIVERSITY OF MICHIGAN
GENERAL LIBRARY
ANN ARBOR MICH
2-C

...to all mankind, daily and in many ways. Republic brings profit through its achievements in new and improved alloy and carbon steels, perfected stainless and heat-resisting ones, mechanically perfect electric weld pipe, heat-treated plate, steel casting and other standard and special steels and steel products of unfailing uniform high quality. Soon for the industry, Republic will widen further the doorway to profit by placing in operation the largest, fastest and most modern hot and cold continuous strip mill in the world.

REPUBLIC STEEL

GENERAL OFFICES
CLEVELAND, OHIO

To See What Is Not Yet There

A FAMOUS sculptor once described his art as very simple indeed. "All I do," he said, "is take a block of stone and knock off what I don't want."

There is the truth and nothing but the truth. But it is not the whole truth. He did not tell how he knew what he didn't want. The fact is, of course, that he could not tell us. Such knowledge cannot be passed on; indeed it is not knowledge, it is a faculty. It is creative genius, the practical phase of imagination.

In the rough block the sculptor sees the outline of his statue; on the bare canvas the painter sees the forms and colors he plans to lay upon it. Both translate into reality a conception already formed by the imagination. They see what is not yet there; their technique is but the means by which they bring it into being. Imagination is the first requisite of creation.

But the exercise of imagination is not confined to the fine arts. It enters into every phase of ordinary life. Esthetically it enriches otherwise drab existence; practically it drives man forward from the reality of today to that of tomorrow. What he imagines today he makes the commonplace of tomorrow.

RECENTLY, at a convention of professional psychologists, it was reported that the only basic difference between one hundred men who made $5,000 per year all through the depression and one hundred who did not make more than $35 per week was this quality of imagination. In four different intelligence and personality tests the two groups rated virtually equal. It was in the test for imagination, or creative ability, that the larger earners demonstrated their superiority.

Without putting too fine a point on the cash return, it is true that the richest rewards—whether of cash or contentment—await those who can create new values. The engineer whose imagination sees the new structure before the first beam is rolled; the constructor who sees in his mind the efficiency of a novel plant before he orders the first piece of equipment; the inventor who sees a new gadget performing a new function before the shop is tooled to produce it—all these reveal a creative faculty akin to that of the sculptor and the painter. In their ability to translate these conceptions into reality lies the material success or failure of their efforts.

Naturally many such conceptions go haywire in execution and involve deplorable waste. But it is this creative genius, spurred by the hope of gain and checked by the requirement of competitive survival, that maintains the tempo of practical progress. And imagination is the spring from which flows the myriad of new things and services offered for our service.

All of which emphasizes the importance of conserving and stimulating the creative faculty. Patent laws that secure to the inventor the benefits of his genius and patience must be the foundation of that effort; to keep them abreast of current needs and practice should be a major concern of an industrial economy such as ours.

ANOTHER aspect of the matter is involved in all this talk of a planned or managed economy. Such a program assumes the regulation of both industrial and agricultural enterprise by officials and bureaus authorized to predetermine investment and production on the basis of how much of what things the people can and will consume. Thus, we are told, we can avoid the wastes and inequities of individual enterprise.

Maybe so; on paper it all sounds plausible and appealing. But even though we swallow the dubious assumption that such a control would continue to *stimulate* the creative imagination, we have yet to hear how we should *kill off* the abortions. Now we count on the automatic control of competitive enterprise to apply that purge; however defective and wasteful may be the process. Those who condemn the present order so scornfully have yet to produce any convincing reason to believe that a bureaucracy would function more equitably or more effectively. Bureaucrats, backed by governmental authority, are not noted for the willingness to confess and retrieve their mistakes.

Willard Chevalier

ENGINEERING NEWS-RECORD

Published every Thursday. Vol. 119, No. 20. Price 25c per copy. Subscription, domestic, Canada, Mexico, Central and South American countries, $5 per year. All other countries, $9 a year or 36 shillings. Entered as second-class matter October 29, 1936, at the Post Office at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Cable address "McGrawhill New York." Member A.B.P. Member A.B.C.

Copyright 1937 by McGRAW-HILL PUBLISHING COMPANY, Inc.

Editorial and Executive Offices: 330 West 42d St., New York. Publication Office: 99-129 N. Broadway, Albany, N. Y. Branch Offices: 520 N. Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, London, W. C. 2, England; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston, Atlanta, Ga.

JAMES H. McGRAW, JR., *President* HOWARD EHRLICH, Exec. Vice President JAMES H. McGRAW, Honorary Chairman
WILLARD CHEVALIER, Vice-President B. R. PUTNAM, Treasurer D. C. McGRAW, Secretary A. W. MORRISON, Circulation Manager

If a Preformed Wire Rope is the most suitable for your equipment, you can depend on Preformed "HERCULES" (Red-Strand) Wire Rope for maximum efficiency. Available in both Round Strand and Flattened Strand constructions. It pays to use the best.

The crack basketball team works as a well-balanced unit. Dribbles and lightning passes from player to player form the "set-up" for shooting the basket . . . impossible, unless each man does his part.

Good Wire Rope, too, must work as a well-balanced unit. Those essential characteristics of strength, elasticity, durability, flexibility and toughness must be perfectly coordinated—each helping the other—to make an enduring, economical wire rope. And none of these five essentials should be more important than the others!

This balanced construction is the reason "HERCULES" (Red-Strand) Wire Rope is so efficient—so economical—and so long lasting. It's wire rope that offers you the advantages of "teamwork" over the weakness of "grandstand" play.

WIRE ROPE MAKERS **A. Leschen & Sons Rope Co.** ESTABLISHED 1857

5909 Kennerly Avenue, St. Louis, Mo.

New York	90 West Street	San Francisco	520 Fourth Street
Chicago	810 W. Washington Blvd.	Portland	914 N. W. 14th Avenue
Denver	1554 Wazee Street	Seattle	2244 First Avenue South

· ENGINEERING NEWS-RECORD ·

McGRAW-HILL PUBLISHING COMPANY, INC.

WILLARD CHEVALIER, *Vice-President*

Editorial and Executive Offices: 330 West 42nd Street, New York . Publication Office: 99-129 North Broadway, Albany, N. Y.

F. E. SCHMITT, *Editor* ALBERT E. PAXTON, *Manager*

Copyright 1937

VOL. 119 *NOVEMBER 11, 1937* No. 20

THIS WEEK AND NEXT

NEARLY a score of years ago, a public works conference met in Chicago and decided that a national public works department was desirable. Arguments for such a department are summarized by Alonzo J. Hammond, Chicago consulting engineer and chairman of the American Engineering Council public works committee.

Some five million yards of grading are required to level off the grounds for the new Irvin Works of Carnegie-Illinois Steel Corp., for these mammoth rolling mills are being built among hilltops instead of on a conventional valley site. It's a big job, described in this issue.

Last week Lewis H. Tuthill pointed out ways in which the concrete mixer could be improved. This week Charles S. Ball confines his theme to the truck mixer, and states that it is a refined mechanism which aids merchandising ready-mixed concrete.

The Department of Commerce Bureau of Labor Statistics has prepared a report from the results of an income and earnings questionnaire answered by 52,000 engineers. An abstract of the report is on page 787.

An example of county road commission development is presented in the story of the evolution of the highway network of Wayne County, Mich., from grass and dirt roads to a system of super-highways in little more than a generation.

Cost figures for concrete placing under various cool and cold weather conditions show up some old theories on material and concrete heating.

NEXT WEEK—A construction story of the Seminoe Dam on Wyoming's Kendrick irrigation project.

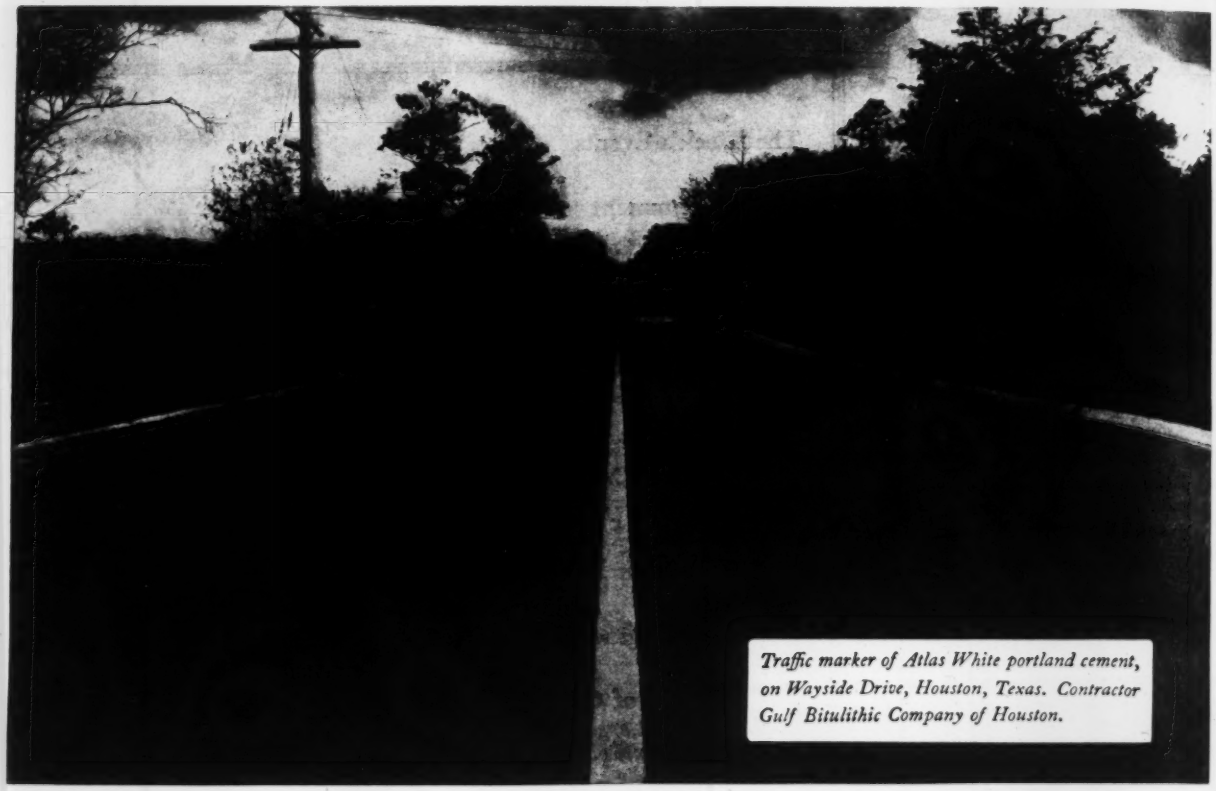
		PAGE
The Week's Events		767, 800
Reader Comment		774
Editorials		776
Pictures in the News		778
Why a Public Works Department?	ALONZO J. HAMMOND	779
Heavy Grading for Hilltop Steel Mill *(Excavation, Drilling and Blasting)*		781
Truck Mixer a Refined Mechanism	CHARLES F. BALL	786
Report of Engineering Income and Earnings		789
Thirty Years of County Road Progress *(County road organization, Construction practice, Design, Control)*	LEROY C. SMITH	791
Balancing Costs in Winter Concreting	D. S. MACBRIDE	795
From Field and Office		798
New Aids to the Constructor		*Adv.page* 30
Construction Reports		*Adv.page* 39

THE COVER PICTURE shows an elevating grader being used to level off the ground for the new Irvin Works of Carnegie-Illinois Steel Corp., near Pittsburgh. Some 5,000,000 cu. yd. of rock and earth were moved on this job.

Number of copies of this issue printed 30,232

Goodbye....

TO MARKER MAINTENANCE COST



Traffic marker of Atlas White portland cement, on Wayside Drive, Houston, Texas. Contractor Gulf Bitulithic Company of Houston.

Atlas White traffic markers are permanently white... they last as long as the pavement lasts... their first cost is the last cost

YOU say goodbye to the cost of "keeping up" traffic markers when you install Atlas White portland cement markers. It's true that temporary markers will save some money on installation cost. But *from there on* the picture reverses itself.

For temporary markers, in the long run, usually cost more than permanent markers because you never have to spend a cent on permanent markers, once they are installed.

In fact, markers of Atlas White portland cement actually pay for themselves in the savings they effect. For these permanent markers are placed *in* the pavement, not on top of it. No maintenance is needed to keep them white—they are always white. They last as long as the pavement lasts. They have a permanent, dense, hard, white surface which resists staining and never fades or washes away.

Installing Atlas White traffic markers is a simple job. No costly equipment is necessary. No specially trained workmen are required. Regular crews with simple tools handle the job quickly and easily. Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), 208 South LaSalle Street, Chicago.

M-15

USS

ATLAS WHITE PORTLAND CEMENT

FOR TRAFFIC MARKERS

THE WEEK'S EVENTS

Bids Asked For High Dam At Grand Coulee Project

Bids for completion of world's most massive structure will be open by Bureau of Reclamation on Dec. 10

THE Bureau of Reclamation has asked for bids on completion of the Grand Coulee high dam, foundation structures for which are now being built under a contract held by the Mason, Walsh, Atkinson-Kier Co. The M.W.A.K. contract is expected to be completed during January 1938, and the Bureau of Reclamation hopes to award the high dam contract early enough so that work may proceed without interruption. Bids are to be open by the bureau Dec. 10 at Spokane.

The work on which bids are now being asked includes completion of the Grand Coulee Dam to its full height of 553 ft. above the low point of the foundation; under the low dam contract, the dam will have been brought to a height of 177 ft. Also included is construction of a power plant on the west bank of the river, for which a foundation has been placed under the existing contract, and construction of foundations and a protecting dam for the pumping plant which in the future will raise water from the Grand Coulee Dam reservoir to a balancing reservoir in the coulee itself for irrigation of Columbia Basin land.

One power house now

Foundations for two power houses, one on each side of the river, have already been built. A power house on the west bank of the river, to be constructed under the new contract, will accommodate nine main generating units of 105,000 kw. capacity each. The east bank power house will be constructed later when needed.

The successful bidder will be allowed four years to complete the job, and will be required to post a performance bond of $5,000,000. In addition it will be necessary to post a payment bond of $2,500,000 to assure against default on labor and material bills.

In accordance with the usual practice on Bureau of Reclamation contracts, the contractor will not be required to purchase the materials and equipment which will go into the permanent structure. The bureau will buy these under separate contracts, and the contractor will install the material, with the exception of power house equipment, which will be installed by the Bureau of Reclamation.

Mason City, the town built by the M.W.A.K. Co. to house its 8,000 employees and the main items of the construction plant will be made available to the successful bidder. The latter includes the concrete manufacturing equipment which has been turning out nearly 400,000 cu.yd. of concrete per month. The government holds an option to purchase this equipment from M.W.A.K. for $100,000.

Work under the new contract will involve placing about 5,800,000 cu.yd. of concrete, bringing the total yardage of concrete in the completed structure to 10,300,000. The contractor will also have to place about 158,000,000 lb. of steel and carry out about 340,000 cu.yd. of excavation.

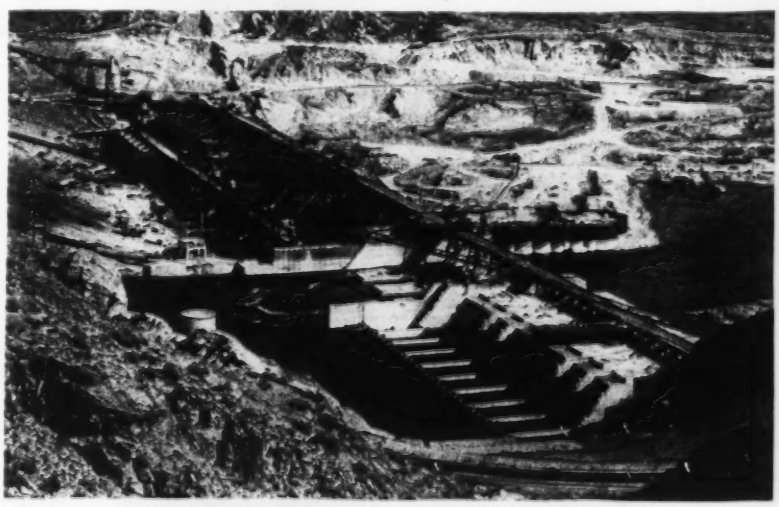
Grand Coulee Dam, when completed, will have a crest length of 4,140 ft. An overflow spillway in the central portion will be 1,650 ft. long and will be controlled by eleven floating-drum gates, each 135 ft. long and 28 ft. high. The spillway will include 30 pairs of outlet conduits to regulate the reservoir during normal operation; each conduit will be controlled by a high pressure gate 8.5 ft. in diameter. An 11-span reinforced concrete arch bridge will cross the spillway.

The dam, which will be the largest feature in the Columbia Basin Federal Reclamation Project, will store water for irrigation of 1,200,000 acres in the Big Bend country between the dam site and Casco, Wash., 200 miles to the South, and for the generation of power.

History of project

The original plan when work on the dam was started in 1934 was to construct a low gravity concrete dam and power plant with an overall height of about 350 ft. and to raise this later by imposing a large dam

(*Continued on page 772*)



GRAND COULEE DAM foundation within a few months of completion, as it appeared Nov. 1

Flood Control Jobs Meet Obstacle

Temporary suspension of Pittsburgh work reveals new policy on flood control

Operations on the Tionesta, Crooked Creek, and Johnstown projects in the Pittsburgh area flood control program were briefly suspended early this month. Although work on the project started again within a few days, the action brought to light a hitherto unannounced policy in regard to flood control projects. No official announcement of policy has yet been made, but it is understood that the federal government will refuse to begin construction on any pending flood control projects which will require future appropriations for completion. This policy will affect many of the projects authorized by Congress at the recent session, when $52,500,000 was appropriated for flood control and expenditure was authorized of an equal amount from relief funds.

Exception for Pittsburgh

On the Pittsburgh work, with all preliminary preparations made for starting construction, army engineers announced that further work would be suspended pending "clarification of technicalities" relating to the $4,006,500 allotted to the three jobs. Although work was started again within a few days, inquiry developed the fact that, with the exception of some small projects on which the present allotments will assure completion, the same "technicalities" apply to all projects on the approved list. The work at Pittsburgh, apparently, was granted a special exemption from the rule.

Because of the secrecy attending the adoption of the new policy, it is impossible to learn the reasons behind it. Some observers feel that it forecasts a sharp cut in next year's flood control appropriation, while others believe that the holdup in beginning long-term projects reflects the administration's belief that some form of regional planning legislation is sure to pass, changing the entire flood control picture.

• • •

Engineers Oppose Dredging Delaware River

The $18,000,000 project for providing a 40-ft. channel in the Delaware River from Philadelphia to the sea was rejected by the Board of Engineers for Rivers and Harbors Nov. 2. The board stated that it was not convinced of the advisability of the project at the present time. It did, however, invite those favoring the project to submit further arguments within thirty days.

A member stated that the board felt that prospective commerce on the river, which now has a 35-ft. channel, was not sufficient to justify the greater depth.

• •

Bay Bridge Authority Studies Ferry Purchase

The California Toll Bridge Authority will consider purchase of the Southern Pacific ferry system across San Francisco Bay at the meeting to be held in Sacramento this week, according to Earl Lee Kelly, state director of public works. The ferry system competes with the San Francisco-Oakland Bay Bridge. It can be bought for $5,000,000 according to Mr. Kelly, who holds that purchase of the ferry system would give the state a monopoly of transportation across the bay, thus making the bridge bonds more attractive and permitting substantial cuts in interest payments.

ARTHUR S. TUTTLE HONORED

As an appropriate climax to a half century spent in the service of the city of New York, Arthur S. Tuttle, former head of the city's engineering force, was awarded a certificate of distinguished service on Nov. 3. The award was made by Mayor F. H. LaGuardia before a large group of engineers and city officials assembled in the historic chambers of the Board of Estimate and Appointment, the body that Mr. Tuttle had served as principal assistant engineer, deputy chief engineer, chief engineer, and consulting engineer for over 30 years.

In presenting the certificate the mayor stated that this is an age in which special training is an essential qualification for public office and that Mr. Tuttle's distinguished service to the city stands out as an example of what can be accomplished by obtaining the right men for such service. He added that Mr. Tuttle's long service shows the advantage of intelligent city planning, that Mr. Tuttle's expert knowledge of the city's engineering problems had been an invaluable asset in passing upon applications for PWA funds during his service as PWA state director, service that had just been terminated at Mr. Tuttle's request.

Gen. Pillsbury Retires

Brigadier-General George B. Pillsbury, Assistant Chief of Engineers, will retire from the Army Dec. 1, 1937, and he has been granted a leave of absence until his retirement becomes effective. His application for retirement was approved by President Roosevelt Nov. 2.

Born in Lowell, Mass., General Pillsbury graduated from West Point with the class of 1900; he is also an honor graduate of the Command and General Staff School and of the Army War College. His early service included road and fortification construction in the Philippines and river and harbor work in Alaska. During the World War he commanded the 102nd Engineers in France and was later division engineer of the 27th Division, engineer of the Second Corps, and Assistant Chief Engineer of the A.E.F. He was awarded the Distinguished Service Medal for his service with the Second Corps. He has served as Assistant Chief of Engineers since June, 1930.

THE CURRENT TREND

This week's news of contract volume and construction cost factors

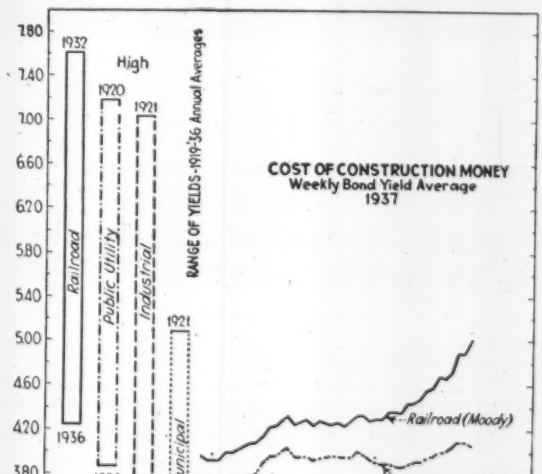
Cost of Money Increases

Municipal Bond Yields Move Upward Uncertainly Industrial Bond Yields Advance More Gradually

State and Municipal bond sales for the past ten weeks have averaged slightly more than $6,000,000 per week compared with an average week to date for the year, for new financing, of $9,000,000.

Mixed causes are responsible, of course, for this decline of which one is the absence of P.W.A. grant allotments requiring loan financing. This situation should change as the new allotments of this fall take effect. Increased cost of financing may have had some retarding effect since the increase has been up then down and has not established a definite trend.

It is unreasonable to expect the extreme low financing costs of 1936 and early 1937 to last indefinitely.



A study of municipal bond yields as published by Standard Statistics shows that since the first of the year yields on municipal bonds have increased, an increase in the cost of construction money. Compared with the range of municipal bond yields over an 18-year period construction money continues to be available at bargain rates.

Industrial bond yields have maintained a lower rate of increase and have not shown a strong sympathetic fluctuation with stock market performances. The average week to date this year for industrial bond sales for construction purposes is $11,000,000. In the past 10 weeks there have been two $10,000,000 weeks, one $12,500,000, two $15,000,000, one $30,000,000 week, and four weeks below $1,000,000. The average is $9,600,000.

Refunding financing has been more affected by market uncertainties than construction financing although doubtless some construction financing is being held up for more favorable prices.

Business Briefs

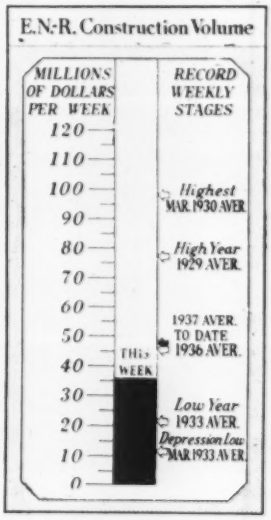
EMPLOYMENT in the production of six major construction materials for September is 63.0 as reported by the PWA Projects Division. This compares with 63.3 for last month and 59.5 for September 1936.

INDEX OF SHIPMENTS of construction materials for September, 97, is 7 points higher than August but 7 points lower than September 1936 according to PWA Projects Division Index. Base, 1929 = 100.

FABRICATED STEEL PLATE orders totaled 341,972 short tons for nine months, compared with 358,763 short tons last year, as reported by the Bureau of the Census. Oil storage tanks increased to 101,982 short tons compared to 77,782 short tons a year ago; refinery material and equipment to 31,079 compared with 29,228 in 1936. Gas holders dropped to 2,962 compared with 6,312; tank cars and blast furnaces 9,699 compared with 24,360; and miscellaneous 196,250 short tons compared with 221,081 for the nine months last year.

TERRA COTTA ORDERS for the 9 months of 1937 total 12,728 short tons compared with 12,704 a year ago, according to the Bureau of the Census. Values of the 1937 orders total $1,402,270 compared with $1,503,734 for the 9 months of 1936.

AVIATION'S REVENUE PASSENGER MILES indicator, 121.1, in air transport for September is a new high for 1937. This is an improvement of 4.8 per cent over August, and 21.1 per cent over September, 1936.



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Nov. 12 1936	Nov. 4 1937	Nov. 11 1937
Federal	$3,168	$2,949	$ 731
State & Municipal	16,464	10,553	20,858
Total public	$19,632	$13,502	$21,589
Total private	18,740	8,925	14,331
TOTALS	$38,372	$22,427	$35,920

Cumulative
1937 (45 weeks) $2,134,156
1936 (46 weeks) $2,026,244

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative. 1936 46 Wks.	1937 45 Wks.
NON-FEDERAL	$830,912	$1,340,584
State & mun. bonds	434,892	442,761
Corporate securities	210,138	489,758
PWA loans, grants	150,884	178,126
RFC loans	24,998	29,939
Fed. aid for highways	.....	200,000
FEDERAL	$691,237	$746,223
TOTAL CAPITAL	$1,512,149	$2,086,807

ENR INDEX VALUES

Index Base	1913	1926
Construction Cost (Nov.)	244.95	117.2
Construction Volume (Oct.)	167	73

Deschutes Project Found Feasible

Step taken towards start of work on Central Oregon reclamation project

The Deschutes federal reclamation project near Madras, Ore., on the Deschutes River has been found to be feasible by the Department of the Interior, and the department's finding has been approved by the President. The finding of feasibility and its approval is required under reclamation law before actual construction of the new project may be begun.

The Deschutes project is an $8,000,000 scheme for the reclamation of about 50,000 acres of land north of Madras in central Oregon. It includes construction of Wickiup Dam, an earth structure 83 ft. high and 3,100 ft. long, flanked by auxiliary dikes 14,900 ft. and 3,600 ft. long, and located 40 miles above Bend. Also included in the project is a main canal extending from Bend north for 55 miles to the Agency Plain near Paxton, a 7,660 ft. steel siphon across the Crooked River, and smaller canals and laterals and minor canal structures.

Approved last year

The project was approved by Congress last year, and an appropriation of $450,000 for starting construction was included in the Interior Department appropriation bill for the fiscal year 1937. This money continued available for the fiscal year 1938, since the project had not been started.

About $2,000,000 of the $8,000,000 cost of the project will be covered by work done by the Civilian Conservation Corps. The remainder of the cost will be repayable in 40 years by water users on the project land.

• • •

Rock Slide Kills Three At Bartlett Dam

A rock slide from the cliff face of the north abutment of the Bartlett dam, a few yards downstream of the structure, killed three men and injured three others on Nov. 1. The rock face apparently was loosened by the vibration of the jackhammers with which the men were working.

Bartlett Dam, on the Verde River in Arizona about 45 miles northeast of Phoenix, is a part of the Salt River federal reclamation project. The contractors on the 270-ft. multiple arch structure are Barrett & Hilp and the Macco Corp.

FORT PECK CORE POOL STRETCHES OUT

COMPLETION of the center closure section of the Fort Peck hydraulic-fill dam to the same elevation as the east bank section has joined the center and core pools into a mile-long lake high above the Missouri River valley. The west bank section is still about 12 ft. higher than the other two.

Over 77,000,000 cu.yd. of fill have been placed in the dam, more than three-quarters of the required total. This view, taken high up on the east abutment, shows the long core pool stretching off into the distance. In the foreground are the outlet tunnel control shafts in which huge ring gates, now being advertised for bids, will be placed. The four houses contain the emergency gate control mechanisms which are now regulating the flow of the river through the four diversion tunnels.

New Head for P W A Power In T V A Territory

Kenneth Markwell has been appointed chief project engineer for the 22 PWA power projects in the Tennessee Valley area, effective November 1. His headquarters will be at Chattanooga, Tenn. Mr. Markwell was formerly state director of Tennessee for the PWA. The new appointment is a part of the general reorganization of the PWA field staff, under which the 22 projects will be transferred to the jurisdiction of the new regional director at Atlanta.

Mr. Markwell will be assisted by Rufe Beardon Newman, Jr., Assistant Chief Project Engineer, formerly Chief State Engineer of the Tennessee state office at Nashville; Carl L. Gerhardt, Chief Electrical Engineer, formerly Assistant Project Engineer at Austin, Texas; Worth Crowley, Chief Counsel, formerly serving in the same capacity at the state office at Nashville, and Ward D. Carpenter, Engineer, formerly State Engineer at Nashville.

Two jobs under way

All of the projects, which involve construction estimated to cost about $24,116,000, are in litigation at present, but Memphis, Tenn. and Sheffield, Ala. have started construction of their distribution systems subject to later court orders. The 22 power projects are located in Alabama, Mississippi, Tennessee and Kentucky.

The projects under Mr. Markwell's supervision will be at Sheffield, Courtland, Decatur, Hartselle, Russellville, Guntersville, Tarrant City, Bessemer, all in Alabama; Starkville and Aberdeen, in Mississippi; Knoxville, Lewisburg, Columbia, Chattanooga, Memphis, Newbern, Paris, Lenoir City, Jackson, Fayetteville and Clarksville, all in Tennessee; and Middlesboro, Kentucky.

• • •

Atlanta Creates Post Of Contact Engineer

The post of contact engineer has been created by the public works committee of the Atlanta, Ga. city council. The action was taken in an effort to obtain more state and county aid for the city's street program, and it will be the duty of the new officer to keep in touch with state and county officials in regard to projects on which the city is asking aid.

G. F. Steele, an engineer employed in the construction department of the city who has been doing similar contact work with WPA and other federal agencies, was named to the new post, to which he will devote his entire time.

Subway Bonds Defeated In San Francisco

San Francisco voters on Nov. 2 voted down a proposal to issue $49,250,000 in bonds to finance construction of an 8½-mile subway system. A $5,000,000 bond issue (*ENR*, Oct. 31, 1937, p. 689) for improvement and extension of the sewer system was rejected, but a $2,850,000 issue for airport improvement was approved.

In Pennsylvania, a constitutional amendment providing for a $42,000,000 bond issue for construction of state buildings was defeated. The amendment was opposed by both parties.

New York state approves a $40,000,000 bond issue for construction of state institutions.

Cincinnati approved a $5,000,000 bond issue for flood control work.

A proposal that the city of Council Bluffs purchase a bridge across the Missouri River owned by the Omaha & Council Bluffs R.R. and Bridge Co. was defeated by a 5 to 3 majority. The bridge, built in 1888, had been offered to the city at a price of $2,500,000; Iowa law compels cities to buy an offered bridge when a price is made if the proposal is voted favorably at a special election. With the proposal defeated, the Omaha and Council Bluffs Missouri River Bridge Board is pushing plans to build a bridge at Dodge St.

• • •

Hogg Appointed Head Of Ontario Hydro

Thomas H. Hogg, chief hydraulic engineer of the Ontario Hydro-Electric Power Commission, has been made chairman of the commission, succeeding T. Stewart Lyon, who resigned Nov. 1. Mr. Hogg retains his position as chief engineer.

Mr. Hogg, who is now 53 years old, graduated from the University of Toronto in 1907 and joined the engineering staff of the Ontario Power Co. In 1911 he left that post to become editor of the *Canadian Engineer*, but two years later he joined the Hydro-Electric Power Commission as assistant chief hydraulic engineer. In 1925 he became chief hydraulic engineer and in 1934 chief engineer.

For the past twelve years Mr. Hogg has been largely responsible for the design of all the commission's power plants. He has served as a consulting engineer for the Canadian government and for the Provincial governments of Ontario, Manitoba and Nova Scotia in connection with hydro-electric problems, and he represented the Ontario government in the Board of Engineers on the St. Lawrence waterway project.

Wide World Photo

NATHAN STRAUS

Recently appointed administrator of the U. S. Housing Authority.

Bids on First Three Sections Of N. Y. Water Tunnel

Bids were opened on Nov. 9 by the New York Board of Water Supply for the first three sections of the Delaware River aqueduct tunnel. The three sections, aggregating 101,100 ft. in length, lie in Westchester and Putnam Counties. Low bidders are:

Contract 322.
Geo. H. Flinn Corp., New York City—$11,996,145.

Contract 323.
Siems-Helmers, Inc., Johnson Drake & Piper, Inc., Leo Butler & Bros. Co., Freeport, L. I., Joint Bid—$10,961,765.

Contract 324.
S. A. Healy Co., Chicago—$10,985,695.

All three sections involve two shafts, each from 310 to 530 ft. deep. The tunnel in the three sections is 15 ft. finished diameter, with 10-in. minimum lining. It is expected most of the ground will require temporary steel supports. Contractors will be allowed 66 months for final completion, though some parts of the projects must be completed before that time. A certified bid check of $350,000 was required for each section; a contract bond of $1,200,000 will be required.

Contract 322, the northerly of the three sections, involves 33,400 ft. of tunnel and Shafts 11 and 12. Contract 323 includes Shafts 13 and 14 and 30,600 ft. of tunnel. Shaft 13 will be a drainage structure, requiring an elliptical shaft 23 ft. 4 in. x 26 ft. 4 in. Contract 324 includes Shafts 15 and 16 and 37,100 ft. of tunnel. Contract provisions provide for bidding on one, two or three sections. Separate shaft contracts are under way.

No Housing Action For Two Months

No applications for low-cost housing are to be considered for 60-day period

Nathan Straus, new head of the U. S. Housing Authority, has declared a 60-day moratorium on consideration of applications for new housing projects under the Wagner low-cost housing act. He thus creates a breathing spell during which his principal task will be to formulate a policy of low-cost housing without frills. Mr. Straus plans to cut down the projects to a simplicity which will provide accommodation for those in the lowest income classification. Also, in this interim, rental schedules must be established for a number of inherited PWA projects now ready for occupancy.

Meeting called

As the first step in policy building, Mr. Straus has called for Nov. 22 a meeting of delegates from existing local housing authorities. This meeting will give the local authorities a chance to express their ideas and enable Mr. Straus to explain to them his interpretation of the special conditions imposed by the cost limitation of $1,000 per room and $1,250 per room in the larger cities imposed by the new bill. Mr. Straus interprets the low cost provisions in the bills to imply a maximum rental of $5 to $5.25 per room per month. The limitation of the Nov. 22 meeting to representatives of *existing* local authorities is not intended to discourage formation of additional bodies. It is felt that by eliminating mere observers from the meeting, more definite proposals and plans may be made for early action.

• • •

Aqueduct Noise Case Goes to Trial

Noise in connection with the construction of New York City's $272,000,000 Delaware aqueduct has given rise to a suit which began trial in New York State Supreme Court Nov. 3. The case, brought by residents of Yonkers, N. Y., seeks an injunction against night work and award damages of $322,000.

An informal agreement was made in September between the New York City board of water supply and the Westchester County board of supervisors to confine blasting to daylight hours as much as possible and to take precautions for the reduction of noise (*ENR*, Sept. 23, 1937, p. 527.)

LABOR NOTES

A FINAL settlement has been made of the labor dispute at the Irvin Works of the Carnegie-Illinois Steel Corporation (*ENR* Nov. 4, 1937, p. 736). Carpenters walked out on the job in protest against employment of non-union workmen by the Rust Engineering Co., building a water intake, and the Diamond Construction Co., which is constructing a restaurant on the grounds. Both companies have agreed to employ union men and the 200 carpenters who went on strike have returned to work.

A dispute over the employment of local workers led the Board of City Commissioners of Kansas City on Nov. 2 to order the Swenson Construction Co., contractors on a Montgomery Ward department store building there, to suspend work temporarily. The action was taken after Kansas City unions had protested that local workmen were being discriminated against on the job to an extent which threatened a disturbance of the peace. Mayor McCombs appealed to the Swenson Co. to employ local men and said that, although he had no authority to dictate employment policies to the company, the city found it necessary to shut down the work because of danger of riot.

• • •

Canadian Engineers Union Holds Montreal Meeting

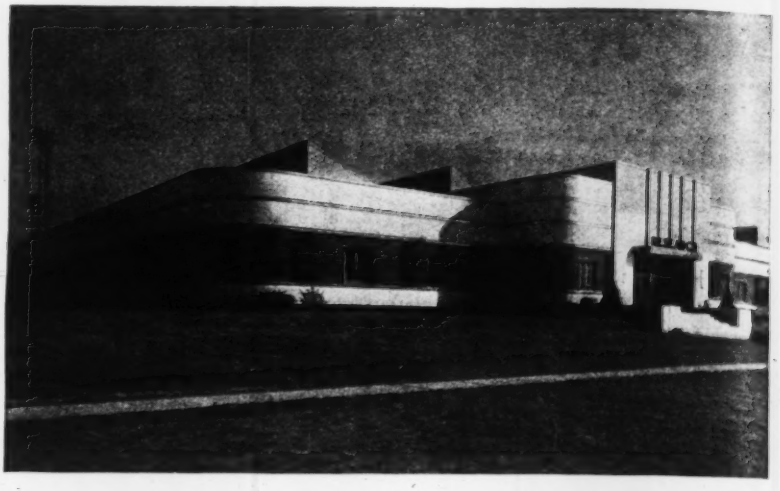
The Association of Technical Employees, Canadian union of technicians, held its first public assembly in the Montreal district on November 3 at Montreal. The chairman was R. J. Tallon, executive secretary of the Trades and Labor Congress of Canada.

The gathering was addressed by Marcel Scherer, national organizer for the Federation of Architects, Engineers, Chemists and Technicians. Mr. Scherer suggested that his audience give up professional illusion and outlined advances obtained by technical employees in the United States through the unionization movement.

• • •

Extra Work Charge

The U. S. Court of Claims on Nov. 1 upheld the contention of Six Companies, Inc., that it should be paid $38,000 to compensate for additional cost in installing refrigeration piping in Boulder Dam to cool the concrete.



ARMCO BUILDING SETS NEW STYLE

LAST WEEK in Middletown, Ohio, the American Rolling Mill Co. celebrated the completion of the new research building built with the fruits of its own research. Distinguishing characteristic of the new building is the wall of cream and black porcelain enamel steel sheets and stainless steel strip, with glass areas of block and plate glass. Sawtooth monitors are also enclosed in glass blocks.

The structural frame of the building is welded, and the building is air conditioned. The building will be described in detail in the Dec. 9 issue.

Designer and builder of the new Armco structure was The Austin Co. of Cleveland.

Court Attack is Made On Bluestone Dam

Condemnation of land for the $13,000,000 Bluestone Dam on the New River was attacked in the U. S. Supreme Court Nov. 2 by the West Virginia Power Co. The company requested a review of a Fourth Circuit Court decision permitting the condemnation.

An allotment of $1,000,000 from 1935 relief funds for the dam included a provision for the use of $800,000 in purchase and condemnation of land. When the government sought to condemn the land in April of last year, the power company obtained a decision from the District of Columbia district court forbidding the action on the ground of unconstitutional delegation of powers.

An appeal by the government to the Circuit Court resulted in a decision that the subsequent passage of the 1936 omnibus flood control act, which authorized the Bluestone reservoir as a part of the Ohio River flood control system, had made the question of legality of the original allotment irrelevant.

In the present suit, the power company contends that the circuit court was incorret in its decision and furthermore points out that the omnibus act provides for local purchase of land.

High Dam Bids

(*Continued from page 767*)

on it. In June, 1935, however, while the contractor was at work on the foundation excavation, the terms were modified to make the contract include construction of a base for the outlet high dam. This work included most of the excavation for the high dam and power plant and a complete foundation structure below the normal high water level of the Columbia river. Under this contract about 17,000,000 cu.yd. of earth and rock were excavated, and about 4,500,000 cu.yd. of concrete will have been placed when the contract is completed.

Immediate construction of the high dam was provided for at the last session of Congress, when $13,000,000 was appropriated for Grand Coulee. (*ENR*, Aug. 12, 1937, p. 251). Of this, only a little more than $5,000,000 will be required to complete the foundation contract, which will cost about $61,000,000. The remainder is thus available to start work on the high dam. Although the 1935 River and Harbor Act authorized construction of the high dam, without making an appropriation, later legislation stipulated that expenditures on the dam should not exceed $53,000,000 unless specific appropriations for a larger amount were made.

New Rate Base Asked By Commission

Power Commission urges supreme court to approve prudent investment basis for rate setting

The Federal Power Commission has submitted a brief to the Supreme Court urging it to accept original prudent investment rather than present replacement cost as a basis for setting utility rates. The brief filed by FTC asks permission to submit oral arguments in the pending case of the Pacific Gas & Electric Co., *vs.* the Railroad Commission of California, involving the validity of certain gas rates ordered by the California Commission. A similar brief has been filed by the Federal Communications Commission.

"The case," according to FTC, "presents issues of great and general public importance, the decision of which will vitally affect the commission and other regulatory bodies and agencies similarly constituted in the conduct of their official duties." The commission urges the court to reject the prevailing valuation rule established in 1898 in the case of Smyth *vs.* Ames: this rule requires the consideration of reproduction costs as an element in determining the valuation of a utility property for rate-setting purposes. The prevailing valuation principle, the power commission maintains, has been tried for 39 years and has been found unsatisfactory. Continuance of the rule will render "well-nigh impossible" the administrative task of fixing electricity rates which Congress has recently entrusted to the power commission.

The Power Commission's brief goes on to state "that a sound basis—sound in administration, in economics, and in law—upon which the public utility properties should be valued for rate-making purposes, is the historical cost of those properties—that is, the prudent investment in them. It believes that such a basis is entirely consistent with the requirements of the fifth and fourteenth amendments to the constitution."

• • •

National Zoning Conference Called by Ickes

A nationwide conference to consider zoning problems and practice for all types of governmental units was called by Secretary of the Interior Ickes Nov. 8. The conference will meet in Chicago Dec. 13-14 under the auspices of the National Resources Committee.

In calling the conference, Secretary Ickes pointed out that most municipal zoning ordinances are from ten to fifteen years old, and that many communities are planning revision of their ordinances. In the comparatively new field of rural zoning, too, he said, there is a need for definition of objectives and policies. The desirability of zoning flood plains for the prevention of unwarranted investment which might lead to further demands for flood protection at public expense will also come in for serious discussion.

85th Birthday

ON NOVEMBER 5, 1852, twelve men assembled in the Croton Aqueduct department office in the City of New York to draw up a constitution and by-laws and to elect the first officers of the American Society of Civil Engineers. From that small beginning the Society has grown to its present membership of over 15,500, and its geographical scope has extended to all quarters of the globe.

Highway Engineer Dies

Thomas S. O'Connell, state highway engineer of Arizona, died Nov. 3 at the age of 49. Except for war service, he had been connected with the Arizona department for 24 years.

Mr. O'Connell began his engineering career in 1909 with the Southern Pacific Co., working first as member of a survey party and then as assistant engineer in the Bakersfield division. After four years with Southern Pacific, he joined the Arizona Highway Department as assistant engineer, holding that position until he joined the army in 1917. During the war he served in the 362nd Infantry.

After the war, he returned to the highway department as location engineer and district engineer. In 1931 he was appointed chief highway engineer, succeeding W. W. Lane, and held that position until his death.

Mr. O'Connell was a director of the American Road Builders Association and a member of the executive committee of the American Association of State Highway officials.

• • •

Aerial Tramway Begun In New Hampshire

Construction of an aerial tramway on Cannon Mountain at Franconia Notch, N. H. began early last month. The project is expected to take about six months to complete. It is being built by the American Steel & Wire Co. of Worcester, Mass. on a bid of $192,000.

New Englanders Oppose Pollution Bill

Governors' conference attacks Barkley-Vinson federal stream pollution bill now in Congress

Provisions of the Barkley-Vinson federal stream pollution bill, now pending before Congress, were attacked by governors of the New England states, meeting in conference Nov. 1. At the eral government to determine the ecosame time the governors asked the fednomic feasibility of power development at reservoir sites on the Connecticut and Merrimac Rivers.

The governors expressed the opinion that federal legislation on stream pollution should provide for cooperative activity among the states by means of interstate compacts and the encouragement of uniform state laws on water pollution obtained through interstate agreement. They said also that the federal government should disseminate information and make available results of federal surveys and studies.

Opposition was expressed, however, to a number of the provisions of federal legislation now pending before Congress. The Barkley-Vinson Bill has been passed by both houses of the legislature, but the Senate measure is considerably the stricter, incorporating a number of provisions of the Lonergan Bill (*ENR*, Aug. 19, 1937, p. 293). It is to the Senate Bill that most of the governors' objections apply.

The governors took exception to two important provisions of the bill: The provision classifying the country's navigable waters into sanitary water districts and giving a federal board power to fix purity standards within each district. The provision declaring that discharge of waste into navigable waters, in violation of the board's regulations, constitutes a public nuisance which may be proceeded against by federal injunction proceedings.

Flood control and power

On the question of the disputed New England flood control compacts on the Connecticut and Merrimac Rivers, to which Congress refused to give its permission at the last session, the governors asked the Secretary of War and the Federal Power Commission to determine whether there are any economically feasible power possibilities at the reservoir sites named in the compacts and what the fair value of such power potentialities may be. It is understood that army engineers are now investigating the potential economic power resources of these two valleys.

News Continued on page 800

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Good Water Evaluated

SIR:—In the article "What Is Good Water Worth" (*ENR*, Oct. 14, 1937, p. 641), figures are given showing an estimate of the value to a community of pure water, calculated on the reduction in the typhoid death rate.

In October, 1919, I read a paper before the Sanitary Engineering Section of the American Public Health Association at New Orleans, from which I quote the following:

"After the opening of the Chicago Drainage Canal in 1900 the typhoid fever death rate per 100,000 in St. Louis gradually increased from 23 in 1899 to 46.74 in 1903. Early in 1904, the clarification process was inaugurated and although throughout the whole year the work was in the experimental stage and the results often uncertain and unsatisfactory, yet the typhoid death rate was reduced to 36 per 100,000 with a further reduction in 1905 to 18.36. After 1905 the rate never reached this figure again, but was steadily reduced during the succeeding years, reaching the comparatively low figure of 12.54 per 100,000 in 1914, the year preceding the opening of the filter plant. The value of this water treatment to the people of St. Louis, inefficient and unsatisfactory as it was, calculated from a health basis alone, runs into figures that are staggering.

"If conditions had remained the same, it is likely that the typhoid rate of 1903 would have steadily increased, but assuming that it would have remained stationary after 1903, if the water supply had not been clarified, a total of 2,536 deaths from typhoid were avoided during the eleven years that the treatment was in use prior to filtration. If the value to the community of the life of each individual be estimated at $3,000, and if we assume that the cost of medicines, nurses' and doctors' services and funeral expenses in each fatal case would have been $250 and that the time lost from work in each case would have been six weeks, valued at $150, we will have a total sum of $3,400 saved for each death avoided, or a grand total of $8,622,400 as representing the money value to the city of St. Louis of the lives saved through the partial purification of its water supply during eleven years.

"It has been calculated from a careful examination of statistics that for every death from typhoid there were from three to four cases which did not terminate fatally. The reports for St. Louis of the number of cases for those eleven years show that out of 7,120 cases 1,245 deaths occurred, that is, a little more than one-sixth of the cases reported were fatal. To be conservative, let us assume that in avoiding 2,536 deaths from typhoid, there were also avoided 7,500 cases where the patients recovered. The actual expenditure avoided in each case for medicines, doctors and nurses, including the value of the time lost from work, could not have been less than $250 which, applied to the 7,500 cases, amounts to $1,875,000.

"Adding to the amount already calculated as the value of the lives saved, we have more than ten million dollars, or almost one million dollars for each year the purification process was in service, as the money value conservatively estimated from the health standpoint alone. The value to the community through being served with a clarified and softened water, which permitted the use of a diminished quantity of soap, which assured much greater convenience and economy for use in steam and hot water plants, which brought about the disuse of private filters and made the purchase of bottled table waters unnecessary, and which relieved the citizens of the necessity for apologizing to their visitors for the appearance of the water in the toilet and bath, can hardly be comprehended, much less calculated in cold figures."

I thought these figures would be interesting to many of your readers as showing that the value of pure water was calculated in 1919 in practically the same way as described in your recent article.

EDWARD E. WALL
Director of Public Utilities.
St. Louis, Mo., Oct. 20, 1937

Not a Constant-Angle Dam

Sir: Your issue of Oct. 14, p. 633, gives a very interesting article entitled "Comparison of Ruby Dam Designs." In the first paragraph Mr. Jorgensen makes the erroneous statement that "* * * contract for the first step in the construction of a constant-angle arch dam at this site was let in August on designs made by the Seattle City Light Department." In justice to the engineers of this department who worked out the design of Ruby dam and who are now supervising the construction of the dam under contract with the General-Shea-Columbia Construction Co., it is only fair to make the following corrective statement:

The structure now under construction at Ruby Dam Site, is not a constant-angle arch dam. The comparative estimates and studies made by Mr. Jorgensen and described in his article were made on his own initiative and presumably for his own satisfaction. He had no connection whatsoever with the staff of the City of Seattle. The design discussed and illustrated is actually a constant-angle arch dam proposed by Mr. Jorgensen for this site, but it is not the design now under construction.

Ruby dam is to be built ultimately to an over-all height of 640 ft. Because of the dense population of the Skagit Valley below the dam, the city of Seattle has insisted that safety be given first consideration in the design of the dam. The details of the ultimate design are not yet complete, but it is expected that the final design will be approximately that used for Boulder Dam. Mr. Jorgensen is correct in his statement that a thinner dam could be built at this site, but his inference that its safety factor would be higher than that of a heavy arch dam is open to serious question.

W. J. MCKEEN
Acting Superintendent,
Department of Lighting,
Seattle, Wash., Oct. 18, 1937

Better Patent Laws Needed

Sir: Many engineers, at sometime or other, feel a yen to patent some sort of gadget and wait for "the world to beat a pathway to their door." After considerable time and money spent in nursing their brain child through the patent office it is rather a rude shock to find that anyone can change the brand of cheese on the mousetrap and secure a patent on practically the same thing.

One who has had this experience knows what Kipling meant when he said "When they scratched the reindeer bone someone made the sketch his own". So much has been said about the patent office being the place to protect ideas that many people believe it and the patent attorney business thrives.

The fact seems to be that a patent is not granted for an idea but only for an appliance, and in order to secure any lasting benefit one must originate something with no possible variation or take out patents on every possible variation.

The worst feature of this "sorry scheme" is that the burden of proof is on the original inventor and the only way he can protect his rights is by a costly suit in federal court.

Experienced inventors may know how to overcome this handicap but the poor guy who has only one valu-

able idea in a lifetime has practically no chance to secure any reward for the time and money spent.

Apparently the patent laws, or their administration, are in need of drastic revision. There should be some organization somewhere with sufficient influence to bring these matters to the attention of Congress and secure correction of obvious injustice.

FRANK B. KING,
Oklahoma City, Oct. 26, 1937

Land Descriptions

Sir: I would like to add one more funny description of a plot of land, which was brought to mind by Mr. Millard's item in your edition of October 14. An old description which I was reading some years ago in New Hampshire seemed to be all very well until we got to the end, and the last paragraph read as follows:

"Whether it be so or not."

JOSEPH F. WILBER
Boston, Oct. 19, 1937

Moist Curing of Concrete

Sir: Although relatively few readers will probably dig into the tabular matter accompanying my article on "The Moist Curing of Concrete" (*ENR*, Oct. 14, 1937, p. 630), there are two or three errors in the first two lines of the table. They are important because they relate to test Series A upon which all of the drawings and much of the discussion are based. The first item in column *I* should be 2890 instead of 1890 lb. per sq.in. Likewise the first item in column *L* should be 3950 instead of 3590. In column *N*, the first two items are printed as 3600 and 3380; these should be 8600 and 8380 lb. per square inch.

H. J. GILKEY
Iowa State College,
Ames, Iowa, Oct. 20, 1937

How Stiff is a Beam?

Sir: The following has reference to a letter by Dean P. Tsagaris in the October 21, 1937 issue, the conclusion of which is misleading.

The last line of the "Analysis" reads "Therefore δ = constant $\times f/E$," and in reaching the conclusion that follows upon this, f is considered as the elastic limit stress, and thus substituted together with the value of E for each of the two metals involved.

However, f is not necessarily the elastic limit stress (Although it may be, and in this particular problem is theoretically, for the steel beam with the given loading of 500 lb.) but a constant, depending only on the loading of the beam when all other conditions of the problem are constant. This may be shown. In equation (3), P is constant, because for the problem it is given as 500 lb. Therefore M is constant. In equation (1) as M is constant, f is constant. The result, when f is constant, is familiar as $\delta = \frac{constant}{E}$

The conclusion to be drawn is thus, that with a varying load, both materials will deflect about the same maximum amount before failure, but the steel will then be supporting about double the load (with twice the internal stress) of the cast iron. With the given load of 500 lb., the steel will deflect a certain amount, and the iron will probably deflect about twice this amount and then fail.

ROBERT FLETCHER
Binghamton, N. Y., October 24, 1937

Women to Inspect Sewers

Sir: This communication refers to a news item in the Oct. 28 issue, p. 697, entitled "Women Allowed to Inspect Buffalo Sewers."

You are of course aware that this piece of news, somewhat enlarged upon, was previously printed in the Buffalo newspapers. Inasmuch as it is typical news item stuff, and as newspapers go to all kinds of people its presence there would elicit nothing more than a smile at most. But when an engineering journal sees fit to give it a place in its pages it takes on a different significance. Engineers, I believe, are supposed to be hard-headed and to deal with a world of facts and not a realm of fancies, so an instance of this kind makes one faintly suspicious that engineers, sometimes at least, take heed of the sinister and foreboding.

Assuming to speak with and for the engineers and technical men of Buffalo we are hoping and trusting that our really excellent friends the "sand-hogs" suffer no direct casualties nor spells of lingering malignity when our rather splendid mothers, wives, and sisters leave their calling cards among the subterranean realms of these courageous diggers.

CHARLES P. LAKE
Buffalo, N. Y., Nov. 2, 1937

[We thought that even engineers would react to this item with "nothing more than a smile."—EDITORS]

No Sales Tricks Needed

Sir: Recently your representative called on me in my office and to my amusement began his standard sales talk. "Do you think," I asked him, "that you have to play all your old tricks on me who has been a subscriber of *Engineering News* and *Engineering Record* since 1906 and of *Engineering News-Record* since the consolidation?"

"You must think very well of our paper," he replied, and I confirmed his remark by telling him how useful the magazine has been to me and especially so when I was working in Central and South America, far away from all other sources of information. I told him how all the back-volumes followed me on packtrains to lonesome construction camps and on steamers to far off shores. In those days they were all packed together with my engineering books in cases specially made to fit the bound volumes. With the years this *Engineering News* library increased to such an extent that lack of space led me to dispose of it. Perhaps it will interest you, as it did your representative, to know what became of the collection.

In the *Proceedings* of the American Society of Civil Engineers had appeared an announcement to the effect that Cornell University wanted back volumes of engineering magazines for a group of Afghan students that had just graduated and were shortly to return to their native land. Whereupon I packed forty-eight volumes for the last time in my old coffin-like boxes and shipped them according to instructions from Cornell. It was my hope that these young engineers and the newly founded engineering school in far off Afghanistan will be benefited as much as I have been from *Engineering News-Record.*

W. ROWLAND
Petersburg, Va., Nov. 2, 1937

ENGINEERING NEWS-RECORD

Copyright 1937, by McGraw-Hill Publishing Company, Inc.

Volume 119, Number 20

Editor, F. E. SCHMITT · *Editorial Staff*, V. T. BOUGHTON
N. A. BOWERS, W. G. BOWMAN, W. W. DE BERARD
C. S. HILL, H. W. RICHARDSON, E. J. CLEARY

Editorial Offices at 330 West 42nd Street, New York

NOVEMBER 11, 1937

A RARE RECORD of public service was honored last Monday in a brief but appropriate ceremony. Standing before a large group of engineers assembled in the quaint old chambers of the Board of Estimate in New York's City Hall, Mayor LaGuardia handed to Arthur S. Tuttle an engraved certificate recording the city's appreciation of a half century of distinguished service, part of it in the position of chief engineer to the Board of Estimate and Apportionment, the principal administrative body of the city. The ceremony was no routine formality; it was one planned by the Mayor, who sent special invitations to many civil engineers outside the city service and to all the heads of engineering departments within the city. In presenting the certicate the Mayor pointed to Mr. Tuttle's record as an example of what the public-service career can be made—a service achievement of which any man may be proud. The brief ceremony bore a significance far beyond the immediate occasion: To engineers everywhere it symbolizes public acknowledgment of their essential service in present-day life.

Performance and Preparation

A COGENT SUMMARY of the conditions and reasons that underlie the movement for a national public-works department is given in this week's leading article, from the pen of A. A. Hammond, past president of the American Society of Civil Engigeers. It should bring home to every engineer that his own fortunes are involved in the question. Efficient, centralized direction of our national public works will of course make public-works construction more efficient and economical; but in addition it will render systematic advance planning and budgeting of federal construction possible, as was brought out in this column a few weeks ago. Through such planning the government will be enabled to hold public works ready for the call of business emergency. The lesson learned during the past half-dozen years, when the collapse of construction threw engineers by the thousands out of work was that the stabilizing power of public-works construction should be held ready for service. A central works department under competent direction would go far to assure this stabilization.

Creative Planning

THE MARCH of modern highway improvement is exemplified by roadbuilding in Wayne County, Michigan. Its story of highway progress, begun in this issue, outranks most other roadbuilding records because of the continuity of development that Wayne County has followed for a generation. From the chaotic ineptitudes of township control it went to centralized county management; then came the adoption of durable surfaces, widening of traffic lanes, 100-ft. and 200-ft. rights-of-way, a master plan of superhighways. Though all highway thinking subsequently followed this line of evolution, it was Wayne County that pioneered. The bold things that it did were new, but back of them was vision, something needed in highway work everywhere. Wayne County's achievements repeat the lesson that bold planning based on vision will inspire interest as small planning never can.

Unusual Grading

PREPARATION of the site for the new Irving Works of the Carnegie-Illinois Steel Corp. involves one of the largest industrial grading projects ever undertaken. Over one hundred pieces of heavy equipment of various types, each selected for certain operations, are moving up to 50,000 cu. yd. daily in a smooth-working fast schedule. Every type of ground from soft muck to hard rock is being encountered. Burning coal beds complicate the excavation attack, and the combustible material must be so placed in the fill as to preclude fire possibility. Grouting of an old cinder fill to seal off combustible material and to forestall settlement is another feature of the work. The manner in which this grading job is being handled is notable evidence of the skill of modern earthmovers.

Stifled Competition

NOT SO MANY YEARS AGO the railroads were held up to public scorn for stifling competition. In those days strong lines cut rates until the competing line went out of business or could be bought at an attractive figure. Out of this and similar abuses of power grew most of our present system of public utility regulation. Now there are signs that the same practice may be revived, but by a public body rather than a private corporation. This week the California Toll Bridge Authority is considering the possibility of buying the ferry lines of the Southern Pacific Ry. that compete with the San Francisco-Oakland Bay Bridge for traffic across San Francisco Bay. It appears that the ferry lines are not

to be bought with the idea of improving the transbay service, but to eliminate their competition, thus making the bridge bonds more attractive and opening the way to a reduction in interest charges and in amortization costs. On superficial examination this objective may appear praiseworthy, but what of its morality? Are not the reasons that make such a practice reprehensible in a private organization just as applicable to a public body? Will the public benefit more by making the bridge bonds more attractive to investors or by the lower rates that competition seems to assure? These are questions that the people of California, and of other states where like questions arise, should ask. With the record of abuse of monopolistic power on the part of the utilities before it, the country should go slowly in opening the way to like abuses on the part of public agencies.

Stress Habits

LONG AGO experience in physical testing and research showed that the byproducts of investigation are apt to be more valuable than the results directly sought for. It is not surprising, therefore, that the interesting tests of knee-shaped steel frames carried out by the Bureau of Standards for the American Institute of Steel Construction have important byproduct teachings. The principal direct result of the tests—to show that knee frames as commonly designed are adequate for the intended service—is, though valuable, of less permanent usefulness than other byproduct findings.

So far the full deductions from the series of tests have not yet been worked out, as is only natural since the tests are still continuing. But already two conclusions important to structural engineers are clear: the first, that the "rosette" method of measuring strains provides us with a powerful and adaptable tool for the study of structural action, from which great future results may be expected; the second, more immediately useful to the designer, that stresses travel along paths determined by the form of the structure and the arrangement of the loads, not necessarily along the paths which the designer would like to have them follow.

Because this second point is fundamental to *good* structural design it will bear some further notice. It emphasizes the fact that stresses have habits of their own, and that the successful designer is the one who learns these habits and shapes his design accordingly. If he does he will design by form as much as by calculation and theory.

The test objects in the Bureau of Standards tests were angular joints, representing the hip of a rigid frame of the type now common, or in effect the connection of a girder to a column by a continuous web of plate and flanges. In some of the test joints the girder flanges continued horizontally to the corners, where they met the vertical column flanges. In such a joint, as the girder deflects under load and bends the column, the tension in the top flange of the girder would seem compelled to travel out to the end of the flange, turn a sharp right-angle corner, and thence travel down the outer column flange. In fact one test joint was fitted with a strong cap plate over the corner to make sure that the tension could go this way. But what happened? The tension left the flange angles some distance from the corner, ignoring the strong cap plate, and made a shortcut through the web, disregarding the fact that no tension-flange section had been provided across this shortcut to carry it.

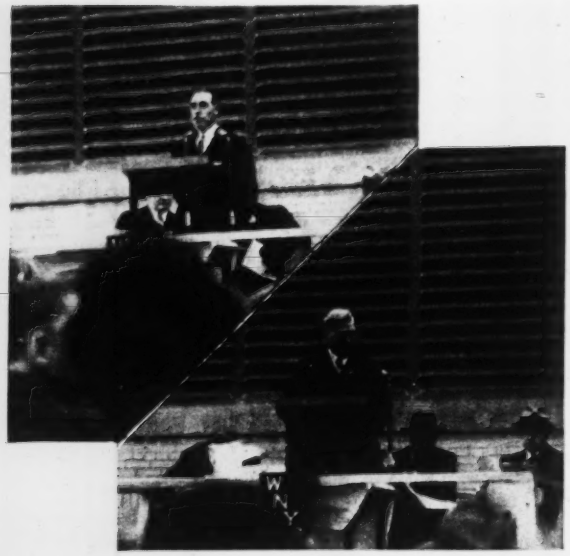
Somewhat similar happenings were observed at the inner corner. The compression in the girder flange did not remain in the flange angles but proceeded on a curved line through the web, around the corner. Probably the extreme reentrant corner of the web plate was stressed very highly; the test setup did not tell. But in gross effect the transfer of compression went by way of the web, in a small zone closely surrounding the corner.

All this, of course, is quite like what occurs in the web of a simple girder, where horizontal and vertical shears combine into large diagonal tensions and compressions that carry the loads down to the shoeplate or to the end connection angles. But in the knee the action is more obviously the direct travel of the main flange stresses along curved lines extending from girder flange to column flange—these curvilinear tensions and compressions being held apart by the strut action of the web.

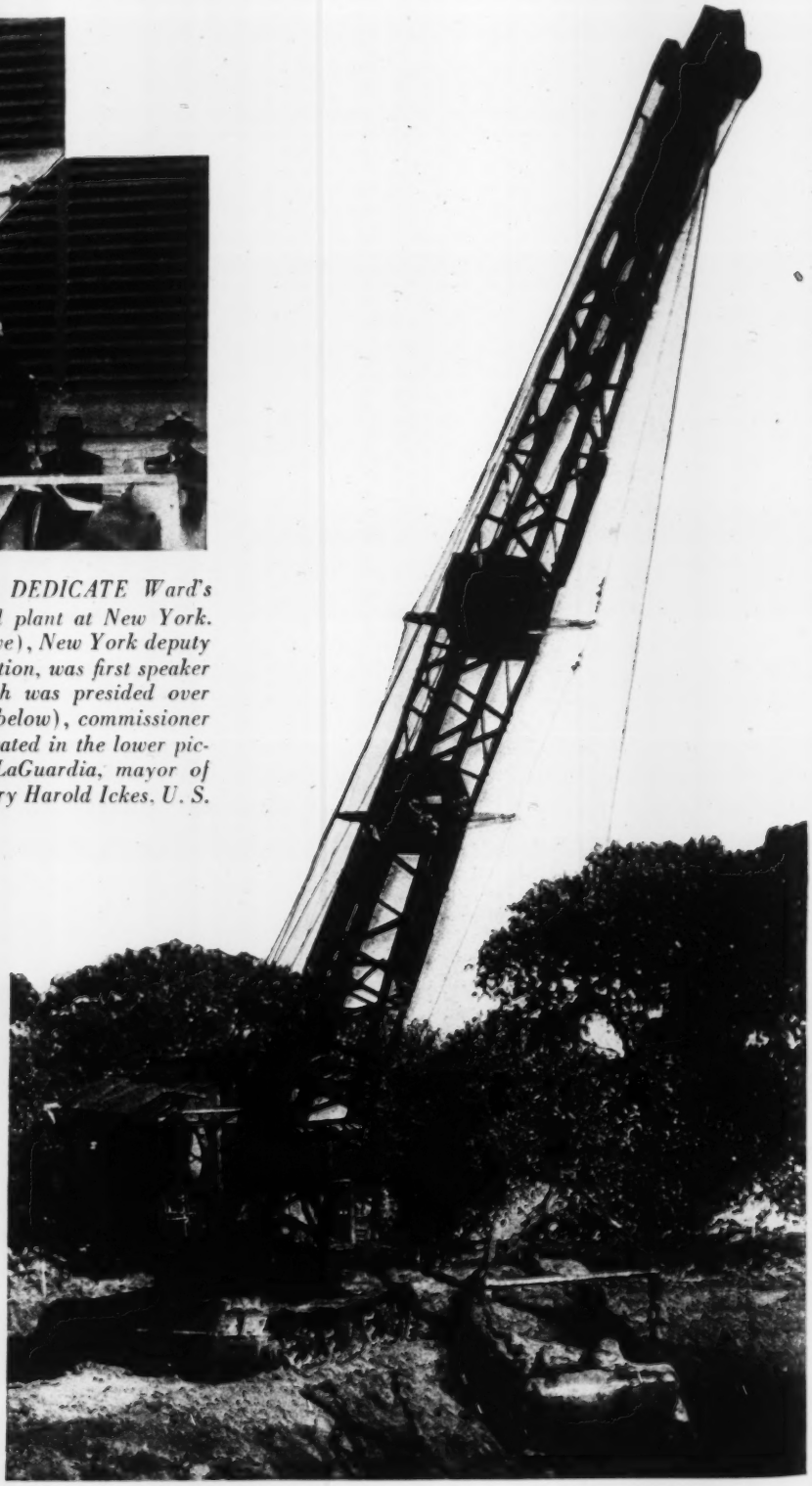
When diagonal or curved flange elements along the shortcut stress paths are provided, these main stresses will find adequate resistance; when no such provision is made, the web must serve. For, as already said, the stresses will go along the lines dictated by the structure's form and loading, with little regard for the designer's wishes.

From the behavior of the test knees it may be inferred, in short, that the structural engineer will find it profitable to study form. Often the most efficient form is more easily determined by trained intuition—result of a keen understanding of how a piece of material behaves in bearing its loads—than by laborious trial designs and calculations. Some simple principles are helpful, for example that in many structures the stresses will follow the most rigid path, which is usually the shortest path: but not often can such principles take the place of the direct appreciation of structural value of form. The master builders of olden times recognized this and wrought marvels in intuitive design of form. The modern structural engineer even with the aid of elaborate theory and analysis will find the old method still useful.

PICTURES IN THE NEWS



ENGINEERS HELP DEDICATE Ward's Island sewage disposal plant at New York. Walter D. Binger (above), New York deputy commissioner of sanitation, was first speaker on the program, which was presided over by William F. Carey (below), commissioner of sanitation. Shown seated in the lower picture are Fiorello H. LaGuardia, mayor of New York, and Secretary Harold Ickes, U. S. PWA administrator.



CENTRAL VALLEY'S great project gets under way as this dragline unceremoniously begins work on the Contra Costa Canal. The canal will be 30 miles long and will extend from Rock Slough to Martinez, California. It is only one of several major engineering features of the Central Valley project.

Why a Public-Works Department?

by Alonzo J. Hammond
Consulting Engineer, Chicago, Illinois

The public benefits from centralization of public-works engineering and construction undertaken by the federal government have long been recognized by engineers and other students of public administration

What reasons support the proposal to centralize our national public-works operations in a single government department? The files of *Engineering News-Record* are rich in editorials and news items on the subject. Now, with the prospect of legislation by the coming Congress on governmental administrative reorganization, it is timely to review the high points of the previous discussions and consider the present outlook for a concentration of national engineering and public-works construction in a single department as a major operation of government.

Plan urged long ago

In April, 1919, at the instance of Engineering Council, representatives from 74 engineering and allied societies met in Chicago for a two-day session on public works, and reached the unanimous conclusion that a national department of public works was desirable. The meeting appointed an educational committee to further the idea. A year later the United States Chamber of Commerce was so impressed with the desirableness of such a department that it submitted to its membership a referendum with arguments pro and con. The result, a vote of 827 for and 549 against such action, revealed an active business sentiment for such government reorganization.

By resolution of both houses of Congress, a joint committee on government reorganization was created late in 1920 to make an investigation and to formulate remedial legislation. The report of this committee, in 1924, limited the work of the Department of Interior to public works and public domain. Hearings were held on the report, but no affirmative action was taken.

The Institute for Government Research made a report on the reorganization of the administrative branch of the national government in 1923. It recommended a national department of public works to carry on all civilian operations, including river and harbor work.

Reorganization of the federal government's numerous departments is now being actively considered.

Creation of a public works department is one of the controversial issues.

In this article the reasons in favor of such a department are set forth by the chairman of the public works committee of American Engineering Council.

Parties pledge their support

A second public-works conference, held in Chicago in 1926 and attended by representatives of 62 organizations, mainly engineering, resulted in a very elaborate study of the various functions and activities pertaining to the administration of federal public works and public domain. Discussion of the proposed reorganization was carried through 1927 and 1928, when a bill was introduced in Congress providing for the transfer to the Department of Interior of the public-works functions of the national government.

In 1928 both political parties were pledged to an administrative reorganization of the government. Action was taken in the 72nd Congress, when two bills were introduced, the title of one reading, "A bill to accelerate public construction in periods of business depression through the creation of an administration of public works, and to provide for a more effective coordination and correlation of the public works functions of the government." These bills established an administrator of public works, who was given exclusive jurisdiction over the design, construction, maintenance, operation and repair of all public buildings and public works under the control of the United States.

Reorganization authorized

Extended hearings were held on these two bills in 1932, and then Congress granted authority to the President to reorganize executive departments by executive orders. In December of that year President Hoover submitted a series of executive orders to the Congress, regrouping and transferring 58 agencies, which, however, were set aside by a resolution of the House of Representatives. The latter action was later declared unconstitutional by the Attorney General, but no changes were made as a result of the order.

The present movement

In March, 1936, President Roosevelt wrote the speaker of the House of Representatives and the Vice-President announcing the appointment of a committee to investigate the executive branch of the government and problems of administrative management. He asked both houses of Congress to create corresponding special committees to investigate the problem and to pave the way for reorganization.

The President's Committee on Ad-

ministrative Management (Louis Brownlow, Charles E. Merriam and Luther Gulick, all well and favorably known in the field of political science and of management) submitted its report and recommendations in January, 1937, outlining a reorganization of the government and the overhauling of the whole executive branch. In harmony with the set-up of any large industrial or commercial enterprise with a president and a limited number of assistants, the committee considered the functions of the present cabinet and new major fields of activity of the government and found two new developments for which there is no adequate place in the present structure. It therefore recommended new departments for the public welfare activities of the federal government and for public works.

The Department of Public Works proposed by the Brownlow committee was: "to advise the President with regard to public works . . . to design, construct and maintain large-scale public works, which are not incidental to the normal work of other departments, except as their agent on request; to administer federal grants, if any, to state and local governments, or other agencies for construction purposes, and to gather information with regard to public works standard throughout the nation." The committee did not assign to the new department particular agencies and bureaus, but "leaves this assignment to the executive when, and if, the Congress enacts a law setting up the general departmental structure."

The Brookings report

In response to the President's request the Senate set up a select committee on investigation of executive agencies of the government, headed by Senator H. F. Byrd, chairman, and this committee in turn engaged the Brookings Institution to prepare detailed studies and reports. Report 14 of the Brookings Institution deals with public works and water resources; it concludes:

(1) The wide diversity of the functions makes it impossible to unite them all in a single department simply because their administration utilizes personnel, technique, and equipment that are vaguely grouped under the heading engineering and are, therefore, assumed to be characterized by interchangeability; and (2) the creation of a central public-works organization to undertake all construction for the federal government does not appear to offer any advantages either in economy or efficiency." It further says that "engineering and construction work in the national government is generally a process incidental to the exercise of a broader, more general function; and the work is so diverse in character that it requires different types of specialists."

Throughout all the recorded discussions of this subject of government administration reorganization, from 1919 to date, there has been a general unanimity of expression in favor of a department of public works, although there were well defined objections to including the river and harbor work of the Corps of Engineers. But here, in the report of the Brookings Institution, we find an objection to creating a public works department, although on the other hand the report favors the transfer of the river and harbor work to a civilian organization.

During the past four years there has been developed a program of public works many times in excess of the usual program of about $200,000,000 a year from 1919 to 1929, and there is the possibility of a continuing large program for many years to come.

Functional necessity

That such a program demands the adequate preliminary investigation of engineering and economic conditions should be axiomatic. The simplest and most efficient set-up for the purpose is a public-works department adequately staffed with an engineer executive who has the combined talent of the administrator and engineer, with the broad outlook and experience that will assure completely developed plans before any public work is allowed to proceed.

This system of dealing with engineering and construction is as definitely and completely functional and the personnel as logical as is the case with the Department of Justice. Who is there that would say we should have other than a distinguished member of the bar as head of that department?

It may be stated as general premise that activities of a civilian character should be allocated to such public-works department, and those for defense to the Navy and War Departments as now.

The fear has been expressed that a department of public works would be so big and unwieldy as to be uneconomic and inefficient. However, most of those who hold this view lack experience with public-works engineering and construction. It is possible to set up a very simple form of organization that will bring into close association all the technical activities involved in public works. Further, the major part of public-works construction is let to contract, so that after completion of preliminary data and plans the operation of the department would be supervisory in character.

Reasons for Centralization

What, in concise terms, are the positive arguments in favor of a separate Department of Public Works?

1. Simplicity would be gained by bringing together activities of common character.

2. Overhead costs would be reduced, in the opinion of experts on cost distribution.

3. Duplication of effort would be eliminated.

4. Employment conditions and opportunities for a high type of technical personnel would be improved.

5. Planning of a financial program would be facilitated.

6. The experience of states and municipalities that have centralized their public works proves the desirability of such procedure, and the practice of the most progressive foreign countries, which for years have carried on their public works through a central department, gives it further support.

One additional point should be set down: We are presumably coming out of a depression, but with no assurance that we will not have another in a period of years. Should another come, a national public-works department would give vitally important service that was lacking in 1930—it would be prepared with a long-range plan for the administration of federal grants and the prosecution of federal public works as balance wheel of employment and industry, and it would provide the organization nucleus for the agencies to carry out the necessary emergency program.

FIG. 1. CONSTRUCTION'S ARTILLERY ATTACKS THE HILLS OF PITTSBURGH FOR NEW STEEL MILL

Heavy Grading for Hilltop Steel Mill

Vast array of equipment is moving five million yards of earth and rock in leveling rolling tract for new Irvin Works of Carnegie-Illinois near Pittsburgh

BREAKING AWAY from an old tradition that has kept steel mill development to the bottom of the valleys, the new Irvin Works of the Carnegie-Illinois Steel Corp., near Pittsburgh, is being built high above the Monongahela River amid rolling hilltops. No simple task is this, building the country's largest current industrial project on a tract 6,200 ft. long and 1,800 ft. wide, for the hills must be sliced off, gullies and depressions filled in and a flanking ridge gouged out to bring the whole site to one level. Preparation of the site involves the moving of some 5,000,000 cu.yd. of material by an impressive array of over one hundred pieces of heavy earth and rock handling equipment working day and night. Interwoven in the excavation and filling operations is the building of concrete foundations and the erection of steel mill buildings.

The site presented peculiar excavation difficulties. It was honeycombed with abondoned coal mines, fortunately shallow and at high level, so the yard elevation could be set below the mine excavations, and the old workings were completely dug out in the general excavation. Seams of coal run through the hills, the disposal of which requires extreme care in distribution in the fill to prevent a concentration of combustible material that might be a future underground fire hazard. Burning beds of coal that had been on fire for 50, or perhaps 100, years are uncovered by the shovels, creating most unpleasant working conditions. The hot, smoking material must be spread out in thin layers and extinguished before being put into permanent fill. Rock—nearly two million yards of it—must be blasted loose, loaded and hauled to parts of the fill that will not be disturbed by subsequent excavation for foundations and utilities. Then there is an old cinder fill, placed years ago, still unconsolidated and full of unburned coal, that requires impregnation with a special grout to solidify the mass and make it incombustible.

New tin and plate mill

Irvin Works will consist chiefly of continuous strip rolling mills for the production and finishing of hot strip, cold reduced tin plate, sheets up to 72 in. wide and ¼ in. thick, and cold reduced automobile stock. Steel will come from the corporation's mills elsewhere in the district, for there will be no steel making facilities at the new plant. The site is on the western side of the Monongahela valley near the town of Clair-

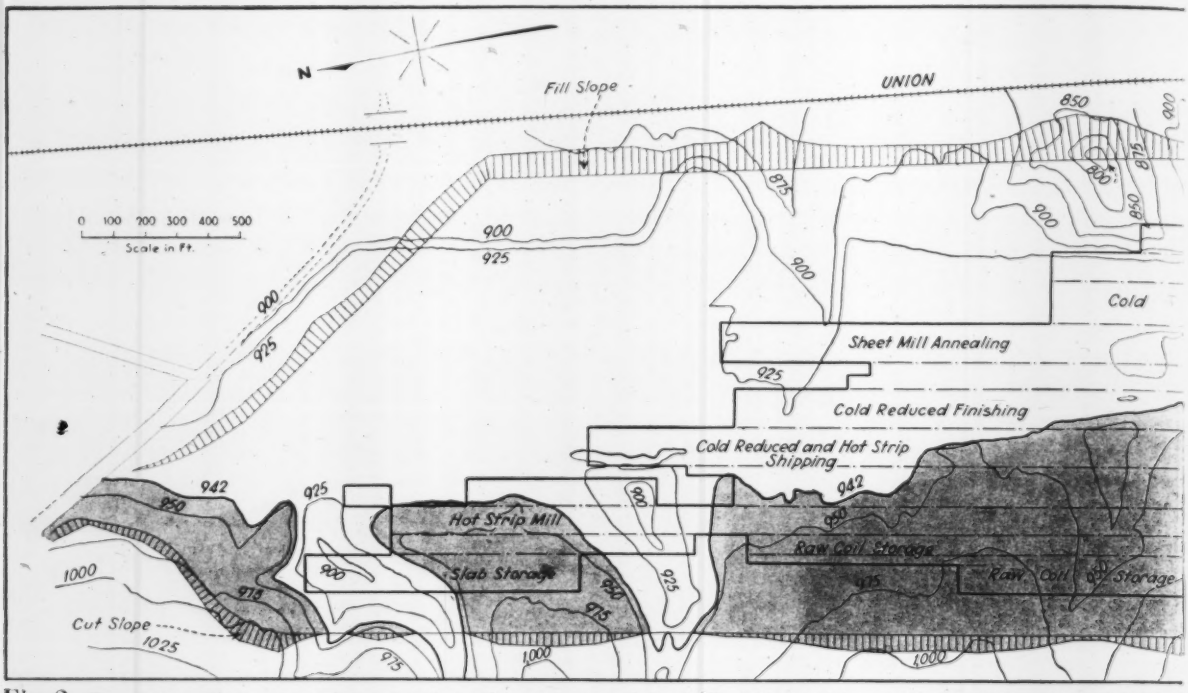


Fig. 2. This huge rolling tract is being levelled off to one general level, El. 942, for the sprawling buildings that will house the steel industry's newest type of rolling mills. The cut area is shown shaded; the space between the 942 contour and the fill slope indicates the extent of filling operations.

ton, Pa., about 15 miles from downtown Pittsburgh. A tract of 600 acres, roughly 6,200 ft. x 3,600 ft., was purchased for the new works, but at present only the eastern half of the site is being developed, and even this provides for considerable expansion without additional grading.

The quantities involved give an idea of the magnitude of the project; 5,000,000 cu.yd. of excavation of all classes of material, including rock, shale, clay, "red dog," coal, cinders, and even swamp muck; 200,000 cu.yd. of concrete distributed among 1,310 reinforced concrete piers, some going down 50 ft. to solid ground; and 26,962 tons of structural steel in 52 acres of buildings that will contain 2,200,000 sq.ft. of floor space. Then, of course, there are the utilities required for the development, such as roads, railroads, water supply, sewers, and power and light services.

An interesting feature of the utilities will be the process water supply, taken from the river. From the intake and pumphouse at the river bank two 42-in. lines will run to a steel reservoir at the top of the highest hill in the undeveloped part of the property. Lime will be added to the supply at the intake to neutralize the acidity in the river water. The reservoir will be a steel tank 178 ft. in diameter, 20 ft. high, with a capacity of 3,740,000 gal. The water will be filtered at the reservoir. Sewers also are of interest, the two main lines being 72 in. in diameter. These and other utilities will be more fully described in a subsequent separate article.

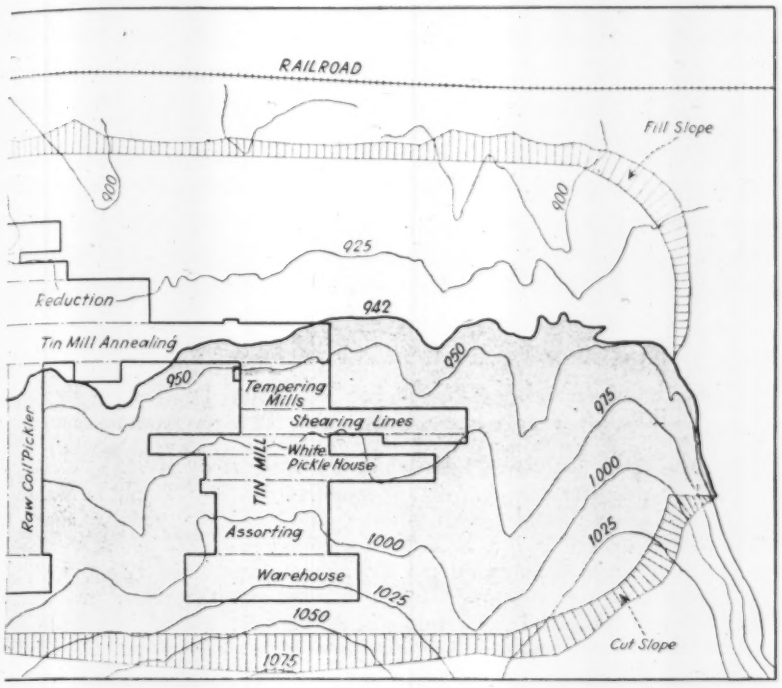
Fig. 3. Another blast signals that more rock is ready for the shovels.

The mill buildings are divided into three general groups—tin mill, cold reduction department and hot strip mill — yet are all connected, laid out to meet modern continuous rolling mill requirements. They spread over an area 4,272 ft. long and 1,196 ft. wide, and any one of the three groups may be extended and enlarged without disrupting the general plan for production. The buildings themselves are simple in design and construction, consisting mainly of steel columns and roof trusses, with corrugated metal sides and roofs.

Foundations for both the buildings and mill machinery are rectangular reinforced concrete piers on wide bases. All of the 1,310 separate piers are on spread footings carried to shale or rock except 170 in an old, deep fill, which are on steel piles.

Conditions at the site

By far the largest item of construction of the new plant is the grading of 215 acres to one level for the present development. Yard level has been established at El. 942, floor level of the buildings is 4 ft. higher. As original contours of the site ran from El. 800 to El. 1,075, the grad-



ing involves maximum fills of 142 ft. and cuts of 133 ft. Because the grading is the critical time factor in the construction schedule, every effort is being made to make it a fast earth moving job. The attempt is successful, for in good going the daily progress reaches 43,000 cu.yd.; in hard ground and rock the output slows down to 22,000 to 30,000 cu.yd. per day of three shifts.

This is no ordinary earth moving job. First of all, there are many classes of material ranging from limestone to soft muck, each requiring different equipment and methods of attack. But more important in planning the grading schedule is the procedure to meet the corporation's sequence of plant building and the distribution of the excavated material to place the various classes of fill as desired by the engineers to satisfy local requirements. It is not simply a matter of cutting down the high places and filling in the low spots; it is a complex schedule in making the cuts and filling in needed parts of the plot first, and always meeting the requirement of placing the fill in various locations according to classes of material. Consequently, the job is being handled in an order and with equipment differing from that used normally.

About 40 per cent of the excavation is rock, lying in irregular formation throughout the cut areas. Overlying the rock, in general, is shale, much of it burned to "red dog." Seams of coal run through the shale. From weathered shale the overburden merges into clay and topsoil. One pocket was full of swamp muck. The irregularity of the rock, shale and clay formation results in abrupt changes in material classification as excavation progresses. Naturally, these changes must be met with corresponding changes in excavation procedure.

Grading operations

To meet a fast excavation schedule, the contractor has planted the job with nearly a hundred pieces of heavy earth-moving equipment. Principal plant items include eight 2½-yd. shovels, three elevating graders, six 12-yd. carrying scrapers, 26 crawler dump wagons from 8-yd. to 12-yd. capacity, 22 12-yd. tractor-truck wagons, two big dump trucks, eight bulldozers and 33 diesel tractors for hauling the wagons. Auxiliary excavation plant includes road

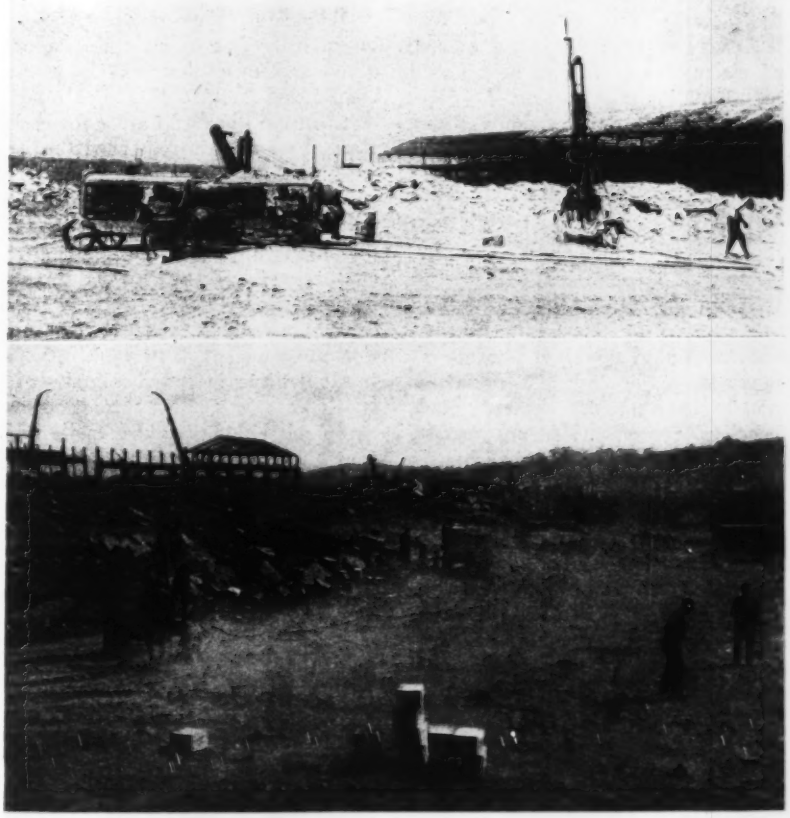


Fig. 4. Some 12,000 lin. ft. of drill holes are put down daily with these wagon drills, powered by portable compressors. The lower view shows a loaded area about ready for shooting.

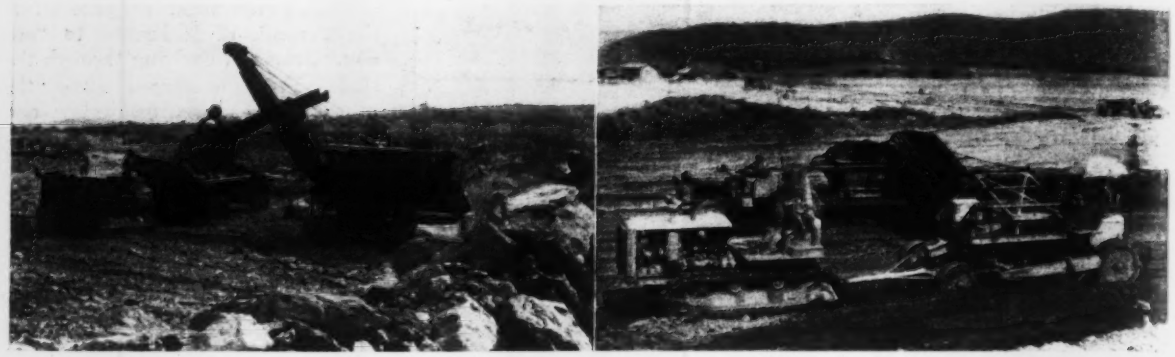


Fig. 5. Hard or soft ground—it makes no difference, for there is equipment available to move it. Rock is handled by heavy shovels loading into flaring dump wagons, while an elevating grader skims off acres of shale and clay.

graders, scarifiers, trench machines, backhoes, backfillers and service trucks. Five crawler cranes are fitted with clamshells for pier foundation excavation.

In general the excavation is carried down in broad benches from 5 to 20 ft. high, depending upon the class of material. Cut and fill operations were concentrated at the southeast corner of the building area at first to enable steel erection to get under way. When possible, filling is withheld in foundation areas until the piers are poured, but sometimes it is necessary in the broad scheme of excavation to fill an area ahead of foundation construction. An early grading job was to provide railroad access to the grounds.

Outside of the foundation areas an attempt is made to carry the fills full height to yard level (El. 942) by side dumping from the wagons, bottom dumping from the tractor-trucks along the top edge and bulldozing over the side of the fill. The distribution of the eight shovels depends upon the class of material exposed in the cut areas. Shale benches, for example, are usually carried deeper than rock benches, so when working in shale a larger number of shovels can be concentrated at one face than is the case in rock.

The elevating graders are used in soft shale, clay and top soil areas where a fairly large and flat tract can be worked. These rigs load into the tractor-trucks, and their excavated product is usually most desirable for fill in the building areas. A scarifier loosens the shale for the graders. The carryall scrapers have the clean-up job, keeping the bench floors free of loose material; they also do some excavation of softer ground, and removed most of the overburden. They are worked both in single and tandem hookup.

Rock and shale, in fact all material excavated by shovel, is hauled in the crawler wagons, the two dump trucks, and the tractor-trucks that are not in use with the elevating graders. The larger wagons, with flaring-side bodies, are reserved for rock haul, while the smaller straight-side wagons are assigned to shale and "red-dog." Frequently the wagons are hauled two or three in tandem.

Obviously, the chief problem in excavation is to maintain an orderly procedure that will keep the plant items from fouling each other, that will keep open fill areas for each class of material and that will utilize trucking routes that do not interfere with free movement of the haulage units. At first inspection the grading operations appear to be in hopeless confusion, but close scrutiny reveals an amazingly smooth-working and orderly procedure. Here is construction management at its best.

All drilling of the rock and shale is done with eight wagon drills equipped with heavy dry drills and four jackhammers used for occasional blockholing. There is no standard drilling pattern, as the character of material varies widely. The holes are put down from 6 to 20 ft. deep, fairly close together. Detachable bits are used throughout, and three length of steel are required for a 20-ft. hole. About 12,000 lin. ft. of holes are drilled daily. Air is supplied by twelve gas-driven portable compressors.

In soft rock and shale it is common practice to spring the holes with dynamite, then reload with black powder. The black powder charges are fired by a dynamite cartridge primed with an electric cap, the cartridge being buried in the center of the powder charge. Sometimes the holes in harder rock are sprung and then reloaded with dynamite, but the usual procedure in the hard ledge is to drill the holes closer together and eliminate the spring shots, and to load the holes all the way to the top to obtain desired fragmentation. Both straight gelatin and ammonia dynamite is used in 20-per cent and 40-per cent strengths, depending upon the character of rock. Firing is by instantaneous electric caps. Dynamite consumption runs from 10,000 to 18,000 lb. daily, yielding from 20,000 to 25,000 cu.yd. of rock. This yield is considered satisfactory in this type of rock, which is tough and dead and is difficult to shatter.

Foundations

Foundation pits are dug with crane and clamshell, being carried down to shale or rock. Occasionally sheeting of the pit is necessary, but usually the holes are sound and dry. Concrete is poured by a traveling paver equipped with a hoist tower, chutes and spouts. Aggregates and cement are batched at a central plant, the materials come in by rail.

Auxiliary construction includes two 72-in. concrete pipe sewer lines, for which excavation is being done with trenching machines. Two large industrial gas mains had to be relocated at the start of the job, and a high tension power line moved off the site. Few buildings were on the site, the principal one being a brick school now used as field headquarters for the engineers and contractors. The hills were heavily wooded, requiring extensive clearing.

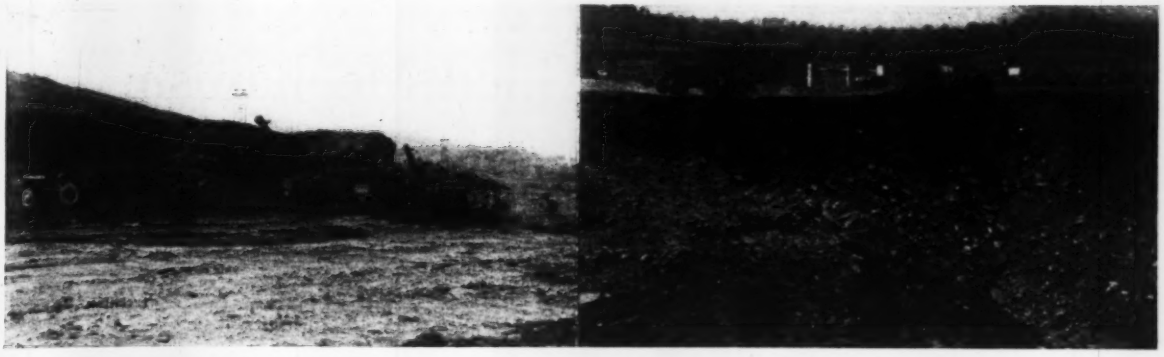


Fig. 6. Start and finish of a long haul. The deep shale banks provide the material for deep fills involving a half-mile haul.

Fig. 7. Forests of concrete piers will carry the buildings and their equipment. Most piers go to shale or rock, though some are on steel piles. This view shows the extent of part of the fill, for yard grade is near top of piers.

To keep the array of equipment in working order the contractor has set up a central machine shop and a warehouse. Running repairs and greasing are done by three field crews who work out of small shops. Shovels, tractors and cranes are serviced by special trucks carrying gasoline and oil. Pneumatic tire service for the trucks and the tractor-trucks is provided by the field shops.

Impregnation of fill

An unusual and interesting operation is the impregnation of the old cinder fill with special grout. At 20x50-ft. intervals sections of 2-in. pipe, open at the bottom joint, are driven 35 ft. deep into the fill. Into these pipes is forced the grout, the pipes being raised as the lower areas fill up.

The grout consists of a mixture of one bag of portland cement, ten bags of first run or unburned cement (which has a slight cementing value) and four gallons of water, mixed in a small concrete mixer. From the mixer the grout is placed in a special tank truck equipped with an outlet hose at the bottom. The hose is connected to the pipe in the ground, and compressed air at 60 lb. pressure is blown into the top of the tank, forcing out the grout. Some of the holes are taking as much as 100 tons of grout.

More details about this grouting process and the results obtained will be given in a subsequent article.

The job is worked three shifts daily. Night illumination comes from seven high timber towers erected along the top rim of the cut and equipped with banks of floodlights. About 750 men are employed each shift.

Construction operations started May 22, 1937, with elaborate ground breaking ceremonies. The present development will be completed sometime next spring. The first steel went up just 46 days after ground was broken.

Irvin Works are being built by the Carnegie-Illinois Steel Corporation, a subsidiary of the United States Steel Corporation, under the general direction of E. T. Lorig, chief engineer of the construction engineering bureau. E. M. Fieger is construction engineer directly in charge of operations, assisted by H. A. Millar. Contract for the preparation of the site and the concrete foundations is held by the joint firm of Guthrie, Marsch & Peterson, made up of A. Guthrie & Co., Inc., of St. Paul, John Marsch, Inc., of Chicago, and the Edward Peterson Co. of Omaha. C. H. Taylor is general superintendent for the contractors. The American Bridge Co., also a subsidiary of the U. S. Steel Corp., is erecting the buildings. The Pennsylvania Drilling Co., of Pittsburgh, is grouting the fill.

Fig. 8. Concrete plant for pouring the piers is a portable paver and tower rig.

Truck Mixer a Refined Mechanism

by CHARLES F. BALL

Chief Engineer, Equipment Division, Chain Belt Co., Milwaukee, Wis.

Truck mixers and agitators have reached a fine mechanical refinement as aids to merchandising ready-mixed concrete

ACCEPTANCE of ready-mixed concrete as a standard material of construction has been definitely helped by the mechanical progress of truck-mixing. Equipment manufacture records few developments of new devices that have been improved as rapidly as have truck mixers and agitator trucks for transporting premixed concrete. Today these machines of the constructor represent the same degree of careful design, structural integrity and fitness to purpose that characterize building and paving mixers, and the first machine, if it exists today, is not much more than ten years old. In a broader sense truck-mixers and agitators are the means by which ready-mixed concrete is a practicable commercial product.

It is not proposed beyond an occasional reference here to discuss ready-mixed concrete as a production and merchandising problem. That has been excellently done in the recent article (*ENR* Aug. 19, 1937) by H. F. Thomson. What are the truck mixer and agitator of today? The beginnings were crude and only one of them endured and came to reasonable perfection.

The original machines of a decade ago were of three principal types: (1) Pugmill open-top truck bodies that were elevated like a dump body, to discharge; (2) Closed drums involving almost no blading action, rotating slowly to agitate, and elevated like a dump body to discharge from the rear while the drum was not rotating; (3) Closed drums containing a number of mixing blades rotating on a horizontal axis, and elevated to discharge while continuing to rotate. Only the last, incorporating improved drum proportions and blading arrangement, has survived and is still supplied to the trade. Soon the last form gave place to closed-drum mixers containing blades for mixing and discharging, rotating on a horizontal axis, loaded through a top opening and discharged through a rear opening without elevating the body. Improved machines of this type are now in majority use.

The structural and operating elements of present truck mixers differ from each other principally in drum shape and proportions, internal blading arrangement, discharge blading arrangement, mounting of the drum, drum drive, power transmission, water measuring system and distributing spout arrangement.

Drum mounts and drives

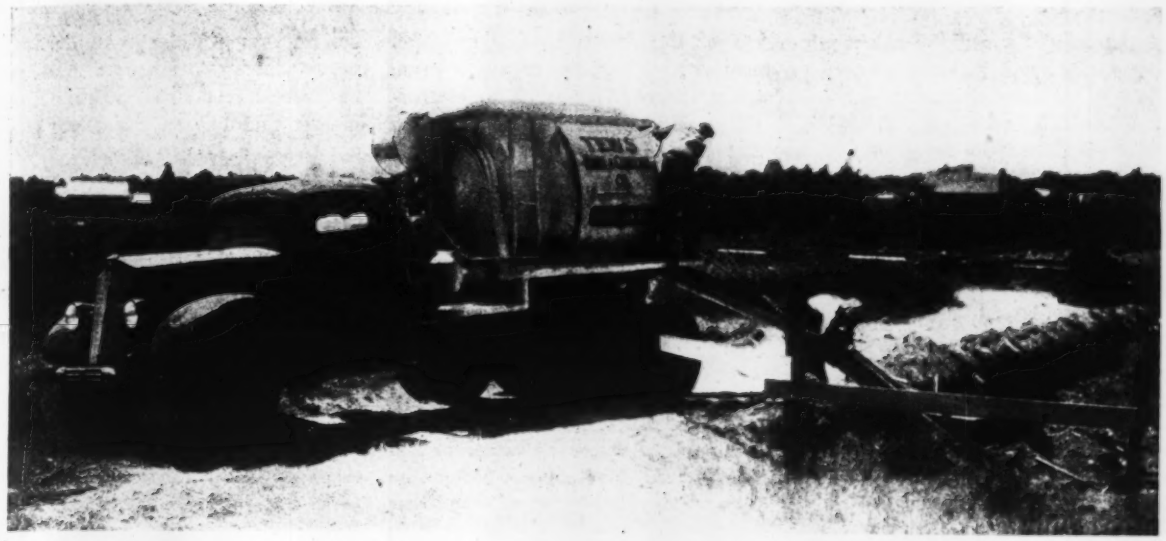
Truck mixers must be designed for both strength and light weight. Because of the weave of the truck frame as the truck passes over an irregular roadway, the machines must incorporate a great degree of flexibility and be able to operate successfully when the several units are temporarily out of line due to frame distortion. To meet these two essential requirements involves the use of high-quality materials and generally high-class construction and mechanisms throughout.

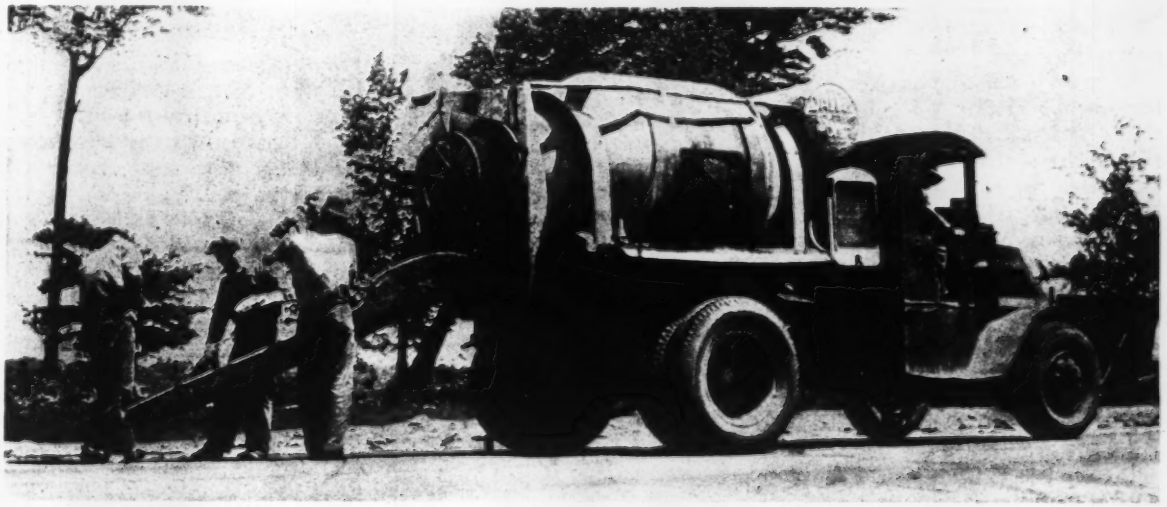
The drums of all principal manufacturers have a three-point mounting with a trunnion bearing at the front end, and two drum rollers supporting the rear end. In one design the entire thrust load is taken by the trunion bearing, and in others by flanges on the drum rollers. For a given capacity, the drum volumes are substantially the same for all makes, and the maximum rated capacity in cubic yards of truck-mixed concrete is 50 per cent of the total interior volume of the drum. Some drums are cylindrical with the cone portion only at the front end.

In all designs the drum shape and internal blading cooperate to give an end to end mixing action as well as a tumbling or roll-over action due to the rotation of the drum. All drums are top loading with a charging hatch and cover, and the discharge opening at the rear is covered with a liquid-tight cover. The internal blading of the drums tends to move the material away from the discharge opening when the drum is revolved in the mixing direction, and to move it to and through this opening when the direction of rotation is reversed. The normal mixing period is 40 revolutions or more, depending on the method of loading, method of admitting or charging the water, consistency or dryness of the concrete and some other factors. The rate of discharge can be governed either by the speed of the drum or the width of the discharge opening as controlled by the cover or door.

Both gear drive and chain drive to the drum are in common use. For truck mixers, the most common drive is from an independent engine mounted on the mixer frame. In conjunction with the engine, a clutch and reversing mechanism associated with reduction gearing are used. In one design the clutching and reversing functions are combined, and all gears are constant mesh. In other designs a master clutch is used in connection with a supplementary jaw clutch control of the reversing action. Most transmissions of the latter type have two speeds, a standard mixing and discharging speed and a special low speed for agitating.

Occasionally for truck mixers, and frequently for agitators, a power take-off drive is used instead of an





Modern truck mixers embody compact assembly of functional elements and standards of mechanical design to meet the requirements of smooth operation while traveling.

independent drive. This involves taking power from the truck engine, usually from an extended countershaft or a take-off on the side of the transmission case. The power is taken by propellor shaft and chains to a transmission mounted on the truck mixer, and then through the standard final drive to the mixer drum. With this type of drive, while in transit, the speed of the drum depends on the speed of the vehicle. At

destination the drum can be rotated at the desired speed for either mixing or discharging.

Water and discharge control

There are two principal ways of handling the mixing water. For long hauls or delayed delivery, the water is admitted from a tank carried by the mixer through a pipe situated at the axis of the drum. Special orifice arrangements on the pipe have been developed to let the water into the drum and prevent the back flow of the concrete or mortar into the pipe. The tanks vary in arrangement and method of measuring. One consists of a single compartment for both mixing water and wash water; starting with a full tank, the mixing water is first measured out and later, by resetting the measuring device, additional water can be delivered to the drum. Two water systems involve the use of two-compartment tanks, one a measuring compartment for the mixing water and a smaller compartment for wash or extra water. In one system, only the required amount of mixing water is carried and in the other, both compartments are completely filled, and the required amount is measured out as needed. The other principal way of handling the water is to charge the required amount through the charging hatch as a part of the loading operation. The water is either admitted with the batch materials or shortly thereafter.

The spout or distributing chute is standard equipment on all truck mixers and agitators. The several manufacturers have different arrangements for carrying or mounting the spout while in the operative and in transit positions. Almost all machines carry rear-end controls, and the entire operation of discharging and distributing the batch can be handled from the rear of the machine, either by the truck driver or one of the concrete crew. To secure greater spouting range, some mixing bodies are mounted on a hoist-controlled sub-frame. The drum is normally carried in a horizontal position, but at destination the discharge end of the drum is elevated from 2 ft. to 3 ft.

One manufacturer builds side-discharge machines for special uses, with the drums mounted cross-wise instead of longitudinally. The mounting of the drums is similar to an ordinary concrete mixer with a drum track at each end and four drum rollers. The drums are equipped with a charging hatch and cover, and two axial closures, and can be assembled to discharge from either end as desired.

Usually the length of haul allows adequate time for mixing. Where specifications require, batchmeters or drum-revolution counters are used. These devices measure the mixing period in terms of revolutions of the drum and not in minutes as the mixing can be carried on either at full speed or at part speed. After the prescribed mixing period has been completed, it is advisable to continue to rotate the drum at a reduced speed suitable for agitating.

Service provisions

All truck mixers can be used as agitators for hauling premixed concrete or for shrink mixing, i.e., a short-time mix at a central plant, and completing the mix while in transit. When used as agitators the capacity is, roughly, 50 per cent more than when used as truck mixers. It is interesting that less power is required to revolve the drum when loaded to two-thirds or three-quarters of its total volume than is required to turn it when only half full. Concurrently, there is substantially less mixing action.

Truck mixers are built in the following sizes: 1 yd., 1½ yd., 2 yd., 3 yd., 4 yd. and 5 yd. They are mounted on nearly any kind of truck having the proper capacity for the particular mixer involved. In a few cases, truck mixers have been mounted on trailers or semi-trailers. Due to state highway or city requirements, most of the larger size units are mounted on six-wheel trucks. In general, the truck and truck mixer size correspond as far as total weight, truck and tire equipment with the usual trucking practice of the particular community. For the largest cities where big trucks and big loads are customary, the largest size truck mixers are commonly selected. For small cities, say 10,000 to 40,000 population, much of the regular trucking is handled by small, low-priced trucks and small-size truck mixers predominate. The small higher-speed trucks can make more trips per hour or per day than the larger heavy duty vehicles, and they can be maneuvered into position with greater facility. On the other hand, the larger units can deliver substantially more concrete per day at a lower ton-mile cost.

While it is sometimes possible when delivering concrete a short distance from the batching plant to make as many as three or four trips per hour, it is unusual for a ready-mix plant to average as many as ten trips per day per unit even on a good day. Usually the running time to location and back to the plant takes the most time, but, nevertheless, for overall efficiency, rapid batching at the plant and rapid discharge are important. The charging-hatch covers of all machines are designed for rapid opening and closing. The unrestricted discharge of all machines is faster than the concrete can be used except for the most favorable handling arrangement at the delivery point. If the load can be dumped into a large hopper, the discharge can be affected with ordinary concrete in ½ min. to 1 min. Usually due to placing requirements, the discharge is held back either by slower drum speed or throttling with the discharge door or both.

• • •

Canadian Building Gains in Third Quarter

FACTORY construction played an important part in bringing the total Canadian construction activity in the third quarter to a substantially higher total than in the corresponding period of 1936. Total contracts awarded during the third quarter were valued at $68,000,000, compared with $50,000,000 during the corresponding period of last year. Factory building recorded a gain of 385 per cent over last year's third quarter, having increased from only $2,725,000 to $13,000,000.

General engineering awards, which included development of hydro-electric power and projects for the utilization of other natural resources, increased appreciably to record a 66 per cent gain, while commercial building also recorded a substantial gain of 42 per cent. Residential construction volume improved only 8 per cent.

Report of Income and Earnings In the Engineering Profession

Results of a government questionnaire answered by over 52,000 engineers

AVERAGE INCOMES in the engineering profession place this group in the upper brackets of the earning scale, but the best of a group of skilled wage earners are in a better position than those who struggle to maintain a position on the fringes of the profession, according to a report issued by the U. S. Department of Labor, Bureau of Statistics.

This report, prepared from a study requested by the American Engineering Council, contains the results of questionnaires answered by 52,589 professional engineers. It is entitled "Income and Earnings in the Engineering Profession, 1929 to 1934." The information given includes the following: incomes during the three years, 1929, 1932 and 1934; professional classes and amounts of education; ages during the 5-year period.

In pointing out that the average amounts earned by engineers ranked well with other professions, the report stated that in 1929 the average income of graduate engineers with ten years' experience ranged from $3,600 to $4,000 in the various classes. In 1929 only 6.4 per cent of the incomes in the United States exceeded $4,000. Furthermore, from age reports, engineering is a profession in which earning capacity advances and is sustained until late in life.

However, if in these respects the profession appears attractive on the average, its rewards are not great to engineers holding minor positions. Even in 1929 the lowest-paid 10 per cent of the engineers could hope for no more than $2,500 to $3,000, though they might remain in the profession for 40 years. In 1934, exposed as the profession was to the risks of unemployment, the lowest-paid 10 per cent of the engineers with less than five years of experience after graduation earned less than $1,000.

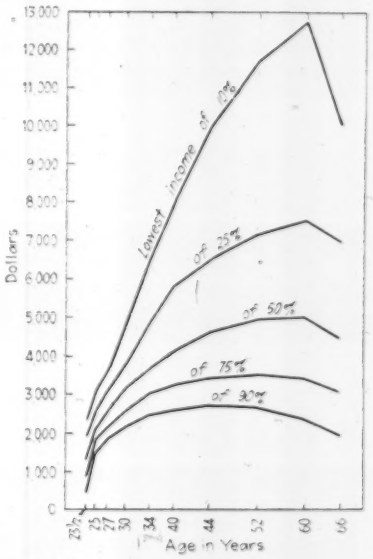


Fig. 1 Graph showing earned annual income of engineers according to age, 1929.

In 1929, 10 per cent of the reporting engineers had incomes in excess of $7,466 per annum. Twenty-five per cent earned more than $5,012, 50 per cent more than $3,412, 75 per cent more than $2,509, and 90 per cent more than $1,878. Comparison of the incomes for 1932 and 1934 with those reported for 1929 shows that from 1929 to 1934, the sharpest absolute declines occurred in the higher income groups. Their percentage decreases were least, however, averaging 31.2 and 31.6 per cent, whereas the middle values of income declined by 33 per cent, and the two lower levels by 41.3 and 53.6 per cent, respectively. Almost two-thirds of these decreases in earned annual income occurred between 1929 and 1932. The average decrease for these years is shown in Fig. 2.

Among the several professional classes, the divergences in earning capacities were most marked in the higher levels of income. Furthermore, the ranking of the profession on the basis of earnings opportunity was the same in the highest 10 and 25 per cent only.

In 1929, 10 per cent of the mining and metallurgical engineers earned more than $9,912 per year, chemical and ceramic engineers ranked second with 10 per cent earning more than $9,103, and were followed in order by mechanical and industrial engineers ($8,508), electrical engineers ($7,185), and civil engineers ($6,507). At the upper 25 per cent level, mining and metallurgical engineers reported earnings of $6,301 per year, and those of the other professional classes ranged from 4 per cent lower for chemical and ceramic engineers to 28 per cent lower for civil engineers. This order of professional classes was also maintained in 1932 and 1934.

In 1929, the earnings of the mining and metallurgical engineers were highest in the middle and two lower levels of income, while those of the electrical engineers were lowest. At these three levels, the earnings of the former were $4,010, $2,839, and $1,985; for the latter they were $3,277, $2,339, and $1,662. Over these three levels the relative positions of the three remaining professional classes changed. There were further shifts in 1932 and 1934.

The data also show that, over the period 1929 to 1934, relatively the smallest shrinkages in earnings were reported by the civil engineers, while the chemical and ceramic engineers suffered the greatest cuts. Over the five income levels, the former ranged from 29.0 to 47.2 per cent, the latter from 35.6 to 63.8 per cent.

Classification by age

Earnings advanced with age in three distinct phases, showing initial periods of exceptionally rapid rise, followed by two others of slower rates of increase. The age spans of these phases varied with the income level. With advancing age, the spread in earnings became most accentuated beyond the age of 38. Thus, at the ages of 44 and 60, the incomes of the upper 25 per cent differed from the median or middle value by 41.0 and 51.0 per cent. The corresponding incomes of the upper 10 per cent at these ages were greater than the median by 116.0 and 157.0 per cent.

Even in 1932 and 1934, this advantage in earning capacity was maintained. The earnings of the engineers in the lower income levels ceased to increase at a relatively early age. These showed a level period before beginning to decline, whereas the higher levels of income showed continuous increases for a considerably longer period, after which, however, they declined at a much greater rate. Over the period 1929 to 1934, a rise in earnings occurred for the youngest engineers who were in the profession in 1929 and who were 30 years of age or less in 1934.

Consideration of the incomes reported by engineers of different educational backgrounds shows that those with a formal engineering education did receive a higher income. The differentials in earnings, however, did not accrue in equal measure for all five professional classes. At about 28 years of age the "other" engineers had lost an initial advantage in earning capacity. At that point, the 1929 earnings of the graduates ranged from $2,725 to $3,000 per year, and those of the corresponding "other" engineers from $2,430 to $2,650.

With advancing age, the spreads in earnings in favor of the graduates became very marked indeed. For example, at 5, 20 and 37 years after graduation, the earnings of first-degree mechanical and industrial engineers exceeded by $175, $925, and $1,322 per year those of the engineers of the same professional class whose college course was incomplete, and surpassed by $225, $1,160, and $1,815 per year those of engineers with a noncollegiate technical school education.

Even in the graduate groups there was variation in the increase in earning capacity among the several professional classes. The 1929 earnings of first-degree civil engineers who had been out of college for 5 years were only $2,050 less than the earnings of those who had graduated 30 years before, whereas the corresponding difference for chemical and ceramic engineers was $3,600. The ranges in earnings of the remaining graduate groups fell between those reported by the civil and the chemical and ceramic engineers.

The report points out that it should not be concluded necessarily that it is wise to encourage men entering college in 1937 to specialize in chemical and ceramic engineering and to discourage their entering the field of civil engineering. Such a fact would be sound only if the conditions surrounding the two fields of engineering and their prospects for the next 20 years are similar to the conditions of 1914 to 1934. It is quite easy to see that a special scarcity value may have attached in 1934 to chemical engineers that did not accrue to civil engineers graduating in 1914. There was a tremendous expansion of the chemical industry in the United States during and following the war. It is a matter of common knowledge that such enterprises had the greatest difficulty in finding sufficient men with the requisite education and experience. On the other hand, while there are more civil engineers and more jobs for civil engineers than in 1914, a decrease in certain types of civil engineering work—as, for example, the construction of new railroads—has acted to restrain the development of relative scarcity values such as may have attached to chemical engineers.

The bureau indicates that it has carefully refrained in this article from describing differences in the average incomes of graduate and nongraduate engineers as a measure of the value of a completed college course in engineering. From the data in hand, it is impossible to determine whether the differences are due to the fact that given individuals have received a college education or to other factors. It is possible that the differences in income arise from an initial process of selection. It is also possible that a prejudice in favor of the college graduate affords him better opportunities to acquire valuable experience than are given to the non-college graduate. In such case, the advantages would arise not from formal education which the man had received but from his status as a college graduate.

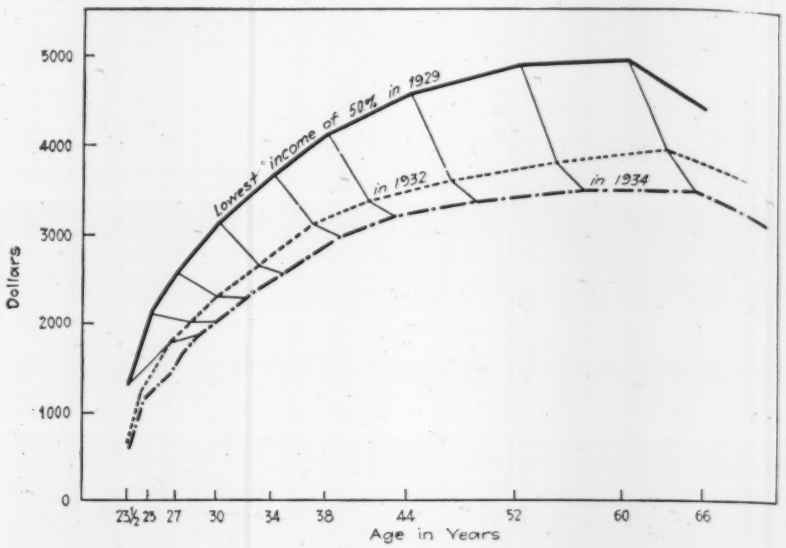


Fig. 2 Graph showing medians of earned annual income according to age, 1929, 1932 and 1934.

• • •

Discarded Tin Cans Turned Into Cash

TIN CANS in the rubbish heaps represent "gold in the mountains" to those cities which have learned other means of disposing of the discarded containers besides carting them to the city dump. The American Public Works Association reports that one method used is to "de-tin" the cans, recovering the tin, and baling the detinned metal, both of which are sold. Another utilization is to bale the cans and ship them to copper smelters for use in the leaching process of extracting copper from the ore; the baled cans are sold as scrap metal. Los Angeles sells its tin cans to a salvage company, and Atlanta also uses a salvage method. Two cities—Tucson and Baltimore—put the cans to use in the manufacture of the deodorant, ferrous chloride. Tucson does the manufacturing itself; Baltimore sells the cans to a private concern for manufacture.

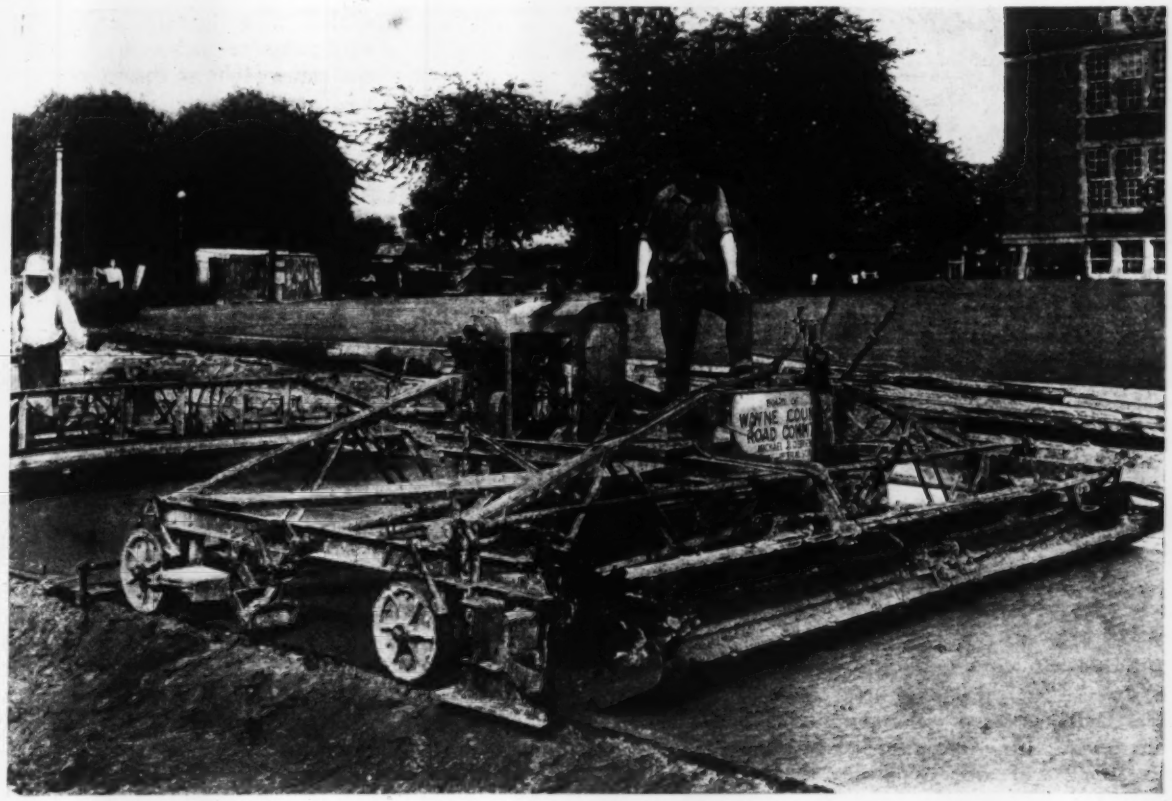


FIG. 1. CONCRETE PAVING IS TYPICAL OF WAYNE COUNTY ROAD WORK.

Thirty Years of County-Road Progress

by LEROY C. SMITH

Engineering-Manager, Wayne County Road Commission, Detroit, Mich.

A statement of construction practice evolved in thirty years' experience in improving a growing system of county roads in Wayne County, Michigan

STARTING from the grass roads less than a generation ago Wayne County, Michigan, has developed a road system to superhighway proportions. Other metropolitan counties have notable superhighway systems but few of them started as early and so low down the scale of highway engineering and road transport service. Wayne County highway system development thus has an epochal character; it exemplies an era of roadbuilding progress. In setting forth present engineering practice there, with occasional glances back to beginnings, a story of common progress is being told.

As related in this article and two others to be published the story has three phases: (1) Organization and general technical practices; (2) growth in road width and geometrical form, and (3) operation for safety. Each of these is a function of highway engineering service to transport and each is an expression of the course of road progress through three decades. It is not as specific examples alone that the practices described are important, rather they are important as indices of highway progress.

Let us notice first what Wayne county is and what its roads are. Wayne county has an area of 626 sq. mi.; it contains 18 townships, 11 incorporated cities of which Detroit is the largest and 14 incorporated and 22 unincorporated villages; the population is 1,888,946, and the county has an assessed valuation of nearly $5,000,000,000. There are some 5,600 mi. of roads and streets of which 2,600 mi. are paved. The Board of County Road Commissioners has under its jurisdiction 2,316 mi. of roads, streets and alleys, which are divided as follows:

1. 480 mi. of paved county roads from 20 ft. to 90 ft. wide surfaced mostly with concrete on rights-of-way from 66 ft. to 204 ft. wide.

2. 682 mi. of secondary county roads (which were formerly town-

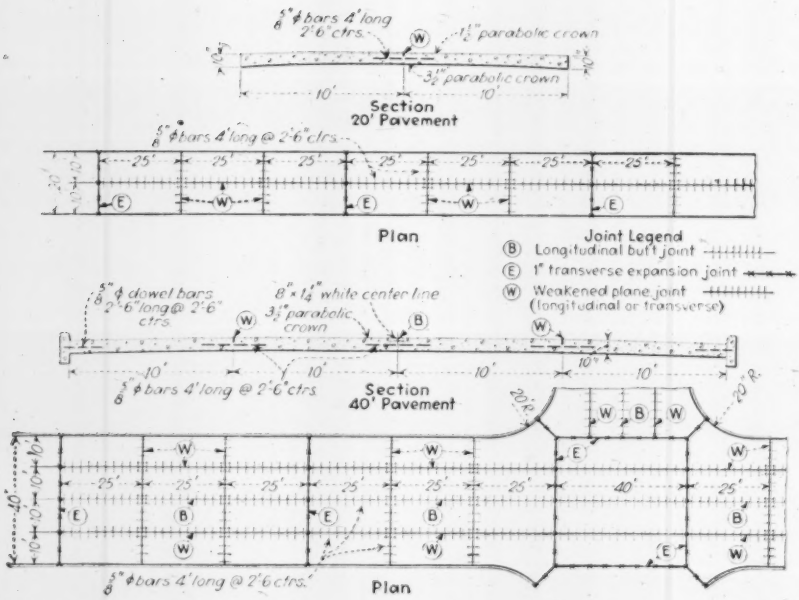


Fig. 2. Joints are a carefully planned detail of concrete pavements in Wayne County.

ship roads) surfaced with gravel at least 20 ft. wide on rights-of-way at least 66 ft. wide; a large mileage of these roads has been surface-treated with asphaltic oils, emulsions, cutbacks and tars.

3. 778 mi. of subdivison streets in recorded plats outside of incorporated villages and cities; these range from dirt or cinders to concrete.

4. 376 mi. of subdivision alleys in recorded plats outside of incorporated cities and villages.

Start of improvement

In 1906 when the present commissioner plan of county road administration was inaugurated, the roads were for the most part clay, sand and swamp roads, although there were a few miles of stone roads; the number of automobiles was almost negligible. The roads were strictly "farm to market" roads and the zone of trade that each individual town counted as its own was generally within a circle of 4 to 6-mi. or, at the most, of 8 to 10-mi. radius.

The roads built in 1907 and 1908 were gravel, macadam and tar-bound macadam. It did not take long to discover that as soon as any considerable length of work was completed, much larger roads were carried and increased traffic resulted. This led to the design and construction of concrete pavements.

During 1909, the first stretch of concrete pavement was constructed on 1 mi. of Woodward Ave. The pavement was built 18 ft. wide and in two courses, totaling 6½ in. deep. The first course was a 1:2½:5 portland cement, sand and crushed limestone concrete 4 in. deep; and the second course was 1:2:3 portland cement, sand and crushed cobblestone concrete 2½ in. deep. The pavement was laid in 25-ft. sections and to provide for expansion, several kinds of experimental joints were constructed: Two thicknesses of three-ply tar paper were used in some sections; a southern pine board, ½-in. thick, was used in others, and in still other sections, wax and pitch were used. In the last case, the edges were protected by angle irons embedded in the concrete and filled between with the wax and pitch.

So much for the beginning, let us now jump ahead almost 30 years to present ways of management and engineering practices. They reflect an era of national highway development by the mirror of a local example of highway and road transport growth.

Organization was required

The Woodward project contained 10,560 sq. yd. of concrete pavement; the concrete pavement placed by road commission forces or contractors now totals about 13,700,000 sq. yd. The vast yardage and related excavation, drainage, structures, etc., necessitated a systematic organization with competent men as heads. Today, the entire highway construction and engineering organization is under the direction and supervision of the road engineer, who is responsible only to the engineer-manager.

Surveying and Inspection—The road engineer directs, through an assistant, all field engineering and inspection. This includes making road surveys and surveys for right-of-way; staking construction projects; inspecting construction operations, whether it be force-account or contract work; preparing field estimates, and sampling materials. The inspection work is purely an engineering function under the road engineer or his assistant and is independent of construction operations.

Designing and Drafting—The designing and drafting are in direct charge of another assistant who is responsible only to the road engineer. In this major subdivision, all survey notes are platted, all designs and computations are made and all plans and maps are drafted. This includes all engineering office work incidental to the acquisition of rights-of-way. In addition, it is here that researches are made, specifications revised and rewritten and records kept.

Force Account Work—The third major subdivision is in direct charge of the construction superintendent who is also responsible to the road engineer. The work of this subdivision includes all force-account construction; the storage and repairing of automobiles, trunks and road equipment, and the operation of material storage yards and stockrooms.

All construction work performed by this subdivision is given as rigid inspection as is the work performed by independent contractors. The costs must be below contractors' costs to justify the existence of the force-account organization.

Work mostly day labor

Although much of the construction, especially during the boom days, was done by contractors, the road commission is primarily a force-account organization; and as such, construction methods had to be developed. At times the changes were gradual; at other times they were sudden and quite radical.

Wheelbarrows to Batching Plants—On the first paving job, the ma-

terials were measured and placed in the mixer in wheelbarrows. As the size of the batch was increased, there was delay, and to overcome this, more men were used in wheeling the aggregate to the mixer. The materials were hauled to the site of the work and dumped along the road in piles, and from these piles they were shoveled into the wheelbarrows. Later, charging hoppers were developed and these were moved with the paver. Today, a modern batching plant is set up at a railroad siding, a main stock pile or a storage yard. The hopper is loaded by a crane. The weight system of proportioning has replaced the volume method on practically all construction work, the exception being small culvert work, curbs and sidewalks.

Truck Haulage Develops—Industrial railway haulage is now rarely utilized in Wayne County because much of the construction is in built-up sections and limited to short stretches. Instead batch trucks are used. But it is only fair to say that the industrial railway has been used very efficiently in the past, and if conditions become favorable, there is no doubt that it will be used again.

Based on economy, it has been found that the best service may be obtained by owning and operating instead of hiring trucks; the cost per hour of operating owned trucks is about three-fifths of the cost of truck hire. This figure is based on actual operating costs and not on estimated costs. Efficiency is increased by direct control over the truck personnel and by putting truck operations all under one head. Also by operating the county's own repair shops the trucks are always kept in the best mechanical condition, insuring good performance and longer life. There is always emergency work in force which would cause much delay and probably dangerous conditions if it were necessary to hire a truck every time an emergency arose. Under the present system, with emergency night clerks and telephone operators on duty, it is a very simple matter to have emergency road service performed within a very short time after the need has been reported at any time of the day or night.

Equipment Repair Service—Complete repair service is furnished all road equipment, automobiles and trucks. No repair job is too small nor too large to prevent it from receiving immediate attention. During the off season, road equipment is completely checked for replacement parts, and if necessary, it is completely overhauled. All equipment is kept neat and clean and well painted; it is interesting to note the few employees required to save many thousands of dollars every year.

Ample facilities are provided for the storage of equipment and materials. Stockroom service is provided for small equipment and supplies. Accurate inventory records are kept and equipment, material or supplies are not permitted to be taken from these storage yards or stockrooms without being properly requisitioned. The project superintendents are directly responsible for the movement of equipment and the transportation of materials and supplies.

Mixing and Placing—The present-day paving mixers equipped with automatic timing devices, water gages and boom and bucket conveyors for placing and spreading the concrete, control the time of the

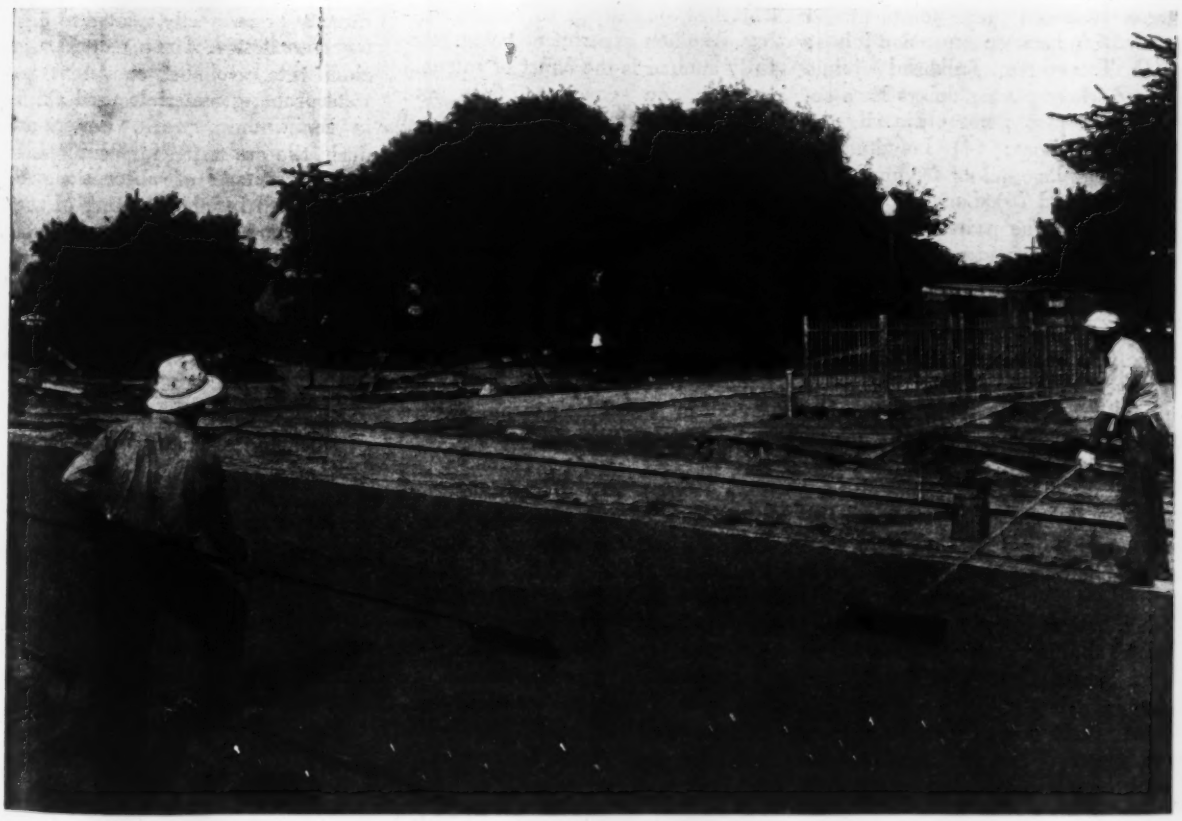


Fig. 3. Nonskid surfaces are secured by brooming the concrete to eliminate glaze.

mix and the consistency of the finished product. Finishing methods have changed with mixing methods. Since hand finishing has been replaced with mechanical finishing, it is no longer necessary to place wet concrete; the latest type finishing machines do the striking off, leveling and belting. Hand floating is kept to a minimum.

Various methods of curing have been used from time to time beginning with the ponding method and the wetted earth method. Wet straw curing is another method that has been used. Paper curing, although still in a more or less experimental stage, has been used to a great extent. Calcium chloride has also been used especially in built-up sections and city streets; the method has been to place calcium chloride solution in the mixing drum in predetermined proportion.

Special design features

Joints receive especial consideration: there are five different types being used at the present time: (1) Transverse expansion joints placed every 75 ft. and at intersections; (2) Transverse weakened plane joints placed every 25 ft. between expansion joints; (3) Transverse bulkhead joints placed where paving delays have occurred at places not ordinarily requiring a joint; (4) Longitudinal weakened-plane joints forming traffic lanes, and (5) Longitudinal butt joints where the pavement placed is to be part of a wider pavement.

The expansion joint being used is a 1-in. premolded joint with a bituminous filler the depth of the pavement. The weakened-plane joint, both transverse and longitudinal, consists of a ⅜-in. elastite joint, 4-in. wide, and ⅝-in. steel bars, 4 ft. in length placed at 30 in. centers just below the paper. The transverse bulkhead joint is formed by placing a bulkhead which is drilled to hold steel dowel bars; one-half of the bar is imbedded in the concrete and the other half extended to be imbedded in the abutting concrete to be placed at a future time. The longitudinal butt joint is similar to the bulkhead joint except that the side form takes the place of the bulkhead. In this case the steel dowel bars are bent to form right angles of equal length legs and one half is imbedded in the concrete; when the abutting pavement is to be placed, the bars are straightened and imbedded in the new pavement when it is placed.

The pavement depths have been increased to meet traffic requirements and at the present time a 10-in. pavement is placed on primary roads and a 9-in. pavement on secondary roads. The advanced theories on superelevated curves have always been followed, but with modern high speeds this is an absolute necessity. Superelevation of curves on existing pavements is being increased by pumping earth under the pavement through holes drilled in the pavement.

Laboratory and field tests

A test road has been constructed in the road commission yard made up of a number of sections, each of different design and with a number of different methods of finishing and curing. The road is being subjected to heavy truck traffic. As an experiment, some of the sections were paved with a very dry mix and the concrete was vibrated. It is the belief here that in the very near future all pavements will be vibrated. In other sections only a burlap finish has been used. This has a tendency to reduce scaling. Another experiment being carefully studied is the effect of salt and chloride on concrete. Salt and chloride is being used on some of the sections in about the same amount as used by municipalities in removing ice from pavements.

The specifications adopted for the construction of highways and the materials used therein follow, in a general way, accepted standards and methods. Some of the standards followed are those of the American Society for Testing Materials, the American Association of State Highway Officials and the American Railway Engineering Association.

In 1927, a testing laboratory was established to test materials and to have a direct control over construction operations. This laboratory functions as a part of the engineering organization, but in cooperation with the other divisions. The main function is to assure that all materials used are of a standard quality and conform to their respective specifications. Another function is the designing and controlling of the proportions of materials used in the various types of wearing surfaces as well as the methods of placing, mixing and curing the product.

In the construction of concrete pavements, it is the responsibility of the laboratory to accept or reject materials that do not conform to the specifications. The proportions of materials used in concrete mixtures are determined by the mortar-void method and the compressive strength by the water-cement ratio. Concrete for pavements is desiged for a compressive strength of 3,500 lb. per sq. in. in 28 days, and it is gratifying to note that practical results obtained verify the theoretical research of the laboratory. Other concrete is designed for a compressive strength of 2,500 lb. and 3,000 lb. per sq. in., depending on the construction.

As a field control and check on the theoretical designs, materials are sampled in the field, cylinders are molded, slump tests run, and all such samples, as well as daily report cards, are submitted to the laboratory. A core-drilling machine is used to drill cores from finished pavements, and these are submitted to the laboratory for tests.

In addition to the materials that are used in concrete, all other materials used in all phases of work directly or indirectly related to highways are tested. These materials include tars, asphalts, emulsions and waterproofing materials used chiefly in maintenance work. Sewer and drain tile are tested for compression and percentage of absorption. All paints used for the painting of road signs, guard rail, equipment, buildings and structures, and for pavement marking are tested at the laboratory before acceptance. Tests are also performed on dust layers to establish their properties.

In order to arrive at a more economical solution of the problem of surfacing secondary roads, an extensive study of soil structures is being made. These surveys are made to determine the type of soil, grading, materials lacking and behavior with water.

Conclusion

With this summary of organization and general technical practices the groundwork is had for considering a major development in metropolitan county highway progress—the growth in road width and geometric form. This progress is outlined in a second article to be published soon.

Balancing Costs in Winter Concreting

by D. S. MacBride*
Lone Star Cement Corp., New York, N. Y.

A new method of finding that winter consrtuction schedule which results in the lowest total cost for time, forms, heat and cement

THE economics of heat protection of winter placed concrete reach farther than mere prevention of freezing but indicates the economy of protecting concrete so that it will harden at a normal rate despite low air temperatures. Thus, heating is a profitable process of concrete placing in spring and fall as well as in sub-freezing winter temperatures. One need not go beyond an examination of the effects upon the strength of concrete exposed to low temperatures after heat protection for various periods as recorded in the table below to be convinced of the value of heat protection.

But the problem here is not to establish a general thesis that is already acknowledged, but to show how to make up an economic balance sheet of heat protection values. The estimating method applies to all types of winter construction. To illustrate the process, a building operation, one of moderate size and ordinary character, is selected. It is presumed also that the reader knows essential heating methods and equipment.

It is a requisite that sufficient heat must be provided to protect the concrete from freezing—that is, until it gains a strength of say 1,000 lb. *Is it cheaper to provide only enough heat to avoid freezing and then wait for service strength, or to give the concrete thoroughly adequate protection until service strength is attained?*

No one answer will fit all cases, because the problem involves the cost of curing and the effect of curing time on job progress and fixed overhead costs.

If only enough heat protection is provided to safeguard against freezing and then wait for service strength, it takes longer to complete the job. Now it costs money (anywhere from $25 to $100 or more) every day the contractor is on a job, and this fixed job or overhead expense has to be figured in the cost comparison.

The cost of curing is made up of (1) cost of heating the concrete aggregates, (2) cost of enclosures and their handling, and (3) cost of supplying heat.

Temperature and exposure conditions govern the first two cost items; they are about the same, whether one protects merely for safety against freezing or for early service strength. But the cost of supplying heat depends upon how long it takes the concrete to attain service strength; obviously, the quicker the concrete hardens, the shorter the heat-protection period and the lower this cost. However, if the cement

*The data used in this article are taken from material copyrighted 1937 by the Lone Star Cement Corporation. All reproduction rights are reserved.

Temperature of Exposure °F.	Heat Protected 6 hr. at 70° F.				Heat Protected 1 day at 70° F.				Heat Protected 3 days at 70° F.			
	Compressive Strength—lb. per sq. in.											
	1d	3d	7d	28d	1d	3d	7d	28d	1d	3d	7d	28d
Total Water in Mix—5 gal. per bag of Cement												
70	3050	4150	4800	5700	3050	4150	4800	5700	3050	4150	4800	5700
60	2450	3600	4200	5050	3050	4000	4650	5500	3050	4150	4650	5600
50	1800	3000	3600	4400	3050	3800	4500	5300	3050	4150	4550	5400
40	1200	2350	3000	3700	3050	3650	4300	5050	3050	4150	4500	5300
30	650	1700	2250	2850	3050	3500	4050	4650	3050	4150	4400	5000
20	400	950	1300	1600	3050	3250	3600	4000	3050	4150	4300	4400
Total Water in Mix—6 gal. per bag of Cement												
70	2350	1400	3950	4800	2350	3400	3950	4800	2350	3400	3950	4800
60	1850	2750	3350	4100	2350	3250	3800	4600	2350	3400	3850	4600
50	1300	2250	2750	3450	2350	3100	3700	4350	2350	3400	3750	4500
40	850	1700	2200	2850	2350	2950	3450	4050	2350	3400	3650	4300
30	450	1200	1650	2100	2350	2800	3200	3600	2350	3400	3550	4000
20	250	700	850	1100	2350	2550	2750	3000	2350	3400	3400	3550
Total Water in Mix—7 gal. per bag of Cement												
70	1750	2700	3250	4050	1750	2700	3250	4050	1750	2700	3250	4050
60	1350	2200	2700	3400	1750	2600	3100	3850	1750	2700	3150	3900
50	950	1750	2200	2850	1750	2450	2950	3600	1750	2700	3050	3700
40	600	1350	1700	2300	1750	2300	2800	3300	1750	2700	2950	3500
30	300	950	1200	1550	1750	2200	2550	2900	1750	2700	2900	3250
20	150	500	600	750	1750	2000	2200	2300	1750	2700	2800	2900
Total Water in Mix—8 gal. per bag of Cement												
70	1250	2150	2650	3400	1250	2150	2650	3400	1250	2150	2650	3400
60	950	1700	2150	2800	1250	2050	2500	3200	1250	2150	2500	3250
50	650	1350	1700	2250	1250	1900	2400	2900	1250	2150	2400	3050
40	400	1000	1350	1800	1250	1800	2200	2650	1250	2150	2350	2900
30	250	700	950	1250	1250	1700	2000	2300	1250	2150	2300	2650
20	100	350	450	600	1250	1500	1650	1800	1250	2150	2200	2300

Temperature of Exposure °F.	Heat Protected 6 hr. at 70° F.				Heat Protected 1 day at 70° F.				Heat Protected 3 days at 70° F.			
	Compressive Strength—lb. per sq. in.											
	1d	3d	7d	28d	1d	3d	7d	28d	1d	3d	7d	28d
Total Water in Mix—5 gal. per bag of Cement												
70	1400	2700	3550	4850	1400	2700	3550	4850	1400	2700	3550	4850
60	1050	2150	2850	4000	1400	2550	3300	4450	1400	2700	3300	4500
50	750	1600	2250	3200	1400	2350	3050	4050	1400	2700	3100	4200
40	500	1200	1700	2400	1400	2150	2800	3550	1400	2700	2950	3850
30	300	850	1200	1750	1400	2000	2450	2950	1400	2700	2850	3400
20	150	400	550	700	1400	1800	2000	2150	1400	2700	2750	2900
Total Water in Mix—6 gal. per bag of Cement												
70	950	2050	2750	3950	950	2050	2750	3950	950	2050	2750	3950
60	700	1500	2150	3100	950	1900	2550	3500	950	2050	2600	3600
50	450	1100	1650	2400	950	1700	2300	3050	950	2050	2450	3250
40	300	800	1250	1850	950	1500	2000	2600	950	2050	2300	2900
30	150	550	900	1300	950	1350	1750	2200	950	2050	2150	2600
20	100	250	400	500	950	1200	1350	1500	950	2050	2050	2200
Total Water in Mix—7 gal. per bag of Cement												
70	650	1500	2150	3250	650	1500	2150	3250	650	1500	2150	3250
60	450	1100	1650	2450	650	1400	1950	2800	650	1500	2000	2850
50	300	800	1250	2000	650	1250	1750	2500	650	1500	1850	2600
40	200	600	950	1350	650	1100	1500	1950	650	1500	1700	2250
30	100	400	650	900	650	900	1200	1500	650	1500	1600	1900
20	50	150	300	450	650	750	850	1000	650	1500	1550	1600
Total Water in Mix—8 gal. per bag of Cement												
70	400	1100	1650	2600	400	1100	1650	2600	400	1100	1650	2600
60	250	800	1250	2000	400	1000	1500	2250	400	1100	1550	2350
50	150	550	950	1550	400	850	1250	1900	400	1100	1450	2000
40	100	400	700	1200	400	750	1050	1500	400	1100	1350	1700
30	50	300	500	800	400	650	850	1100	400	1100	1200	1450
20	20	150	250	350	400	500	550	650	400	1100	1150	1250

Basis of Cost Comparison

Assumed Data for Reinforced Concrete Frame Building

Plain: 80 x 125 ft.

Height: 6 stories and roof

Superstructure concrete: 1300 cu. yd.

Cement: Ordinary portland cement $2 per bbl. and 24-hour cement $2.50 per bbl.

Heating cost: At 50 deg. air temperature, $50 per day and at 20 deg. air temperature, $75 per day

Cost of forms: $2,500 per floor

Construction schedule: 5-day work week; for each floor; 5 days to strip and reassemble forms, place steel and conduits; 1 day to pour concrete, and curing period, according to concrete mix.

content of the mix is increased or if 24-hour cement is used, the cement cost is increased and has to be offset by a saving in heat-protection.

A typical cost comparison

To illustrate one method for finding the most economical concrete mix and heat-curing period, assume the construction of a concrete frame building, using values given in the accompanying box. Since variations in cost of materials, labor, fuel and time will affect the relative economy of the concrete mixes and curing periods, each job should be analyzed separately to find the most economical combination.

Economy requires the lowest total of the following cost items:

1. *Cost of materials*: Changes in mix have little effect upon aggregate costs, so only cement cost per cubic yard is considered.

2. *Fuel and labor cost for protecting concrete*: All concrete in this illustration is deposited at 70 deg., so the cost of heating materials is not included. The variable is in the cost of providing heat protection—fuel cost and labor tending fires.

3. *Cost of forms*: Labor and material required for making up forms.

4. *Straight-time payroll and fixed charges*: These run on regardless of job progress.

A slump of 6 in. and a 5-gal. mix requires 1.95 bbl. of cement per cubic yard; 6 gal., 1.6 bbl., and 7 gal., 1.35 bbl. Thus, cement costs per cubic yard are as given in Table II, for conditions shown in the box.

Costs and methods vary with air temperature. First, take a spring or fall condition with 50 deg. average air temperature. Table I shows that eight combinations of water ratio and heating periods using ordinary portland cement mixes will develop 2,000 lb. in less than 28 days, and six combinations using 24-hour cement mixes will produce service strength in five days or less. So, the problem is to find the mix that produces the lowest total cost for items 1, 2, 3 and 4.

Since a lean mix has a lower material cost but requires longer heat protection than a richer mix, the final choice will depend upon the time cost (straight-time payroll and fixed charges). If this cost is low, it may pay to use a leaner mix, supply minimum heat protection and wait for the concrete to gain service strength. As time cost increases, it will usually pay to use a richer mix and cure sufficiently to develop service strength within a short time. Table III shows the costs of cement and heat at 50 deg. temperature for the assumed building, and indicates the cheapest concrete mix and heat-curing period for three different time costs.

Of the ordinary portland mixes, 6 gal. with 1-day heat curing is cheapest when time is worth $25 a day. But as the value of time increases, 3-day heat-curing with its 2-day saving per floor becomes most economical. The 7-gal. concrete, heat cured one day, is the cheapest 24-hour cement mix for all time values. Also observe that in all cases 24-hour cement mixes show a lower cost than ordinary portland.

This example assumed that the concrete temperature was 70 deg. when deposited, which means heating mixing water to a temperature of 150 deg. in cool weather. But if the materials are not heated, and the concrete is deposited at 50 deg. and cured at 50 deg., the time cost figures are as shown by Table IV.

Comparing these figures with those in Table III, it is seen that for all time values it is cheaper to heat and protect concrete, than to place and cure it without heat protection even at as mild a temperature as 50 deg. Risk of excessive delays from temperature drops is minimized by initial heating of the concrete.

TABLE II — COST OF CEMENT FOR DIFFERENT WATER-RATIO MIXTURES PER CU. YD. OF CONCRETE

Gal. water per sack	Ordinary portland cement	24-hour cement
5	$3.90	$4.88
6	3.20	4.00
7	2.70	3.38

Now, consider the same cost factors, with a winter air temperature of say 20 deg.; all cost assumptions remain the same, except that the heating cost is increased to $75 per day. (Table V). Note that lower temperatures eliminate the 7-gal. ordinary portland mix and place a premium on full heat protection and short curing periods. For 24-hour cement, the 7-gal. 1-day heat-cured mix is cheapest at $25 and $50 per day time value. But when time costs approach $100 a day, the better 6-gal. mix becomes cheaper, because it produces service strength in less time. These figures illustrate the savings at low temperatures from heat curing until service strength is secured. Observe, also, that at all time values and at air temperatures of 20 deg., 24-hour cement costs are lower than ordinary portland costs and by a wider margin than is the case at 50 deg., air temperature.

With slower schedules and two form sets, the cost of the extra form should be offset by a saving in time. Thus, a 7-day curing period increases construction time to 66 days with one form set and 42 days with two, a difference of 24 days. As a set of forms will cost about $2,500, time must be valued at more than $104 per day to make the second form set profitable. Let us now compare two such schedules with an efficient 24-hour cement schedule at an air temperature of 20 deg.

It will be noted (Table VI) that for all time values of more than $6 per day, the 24-hour-cement, one-form-set schedule is cheaper than either one or two form sets using ordinary portland cement.

General conclusions

While variations in the cost of time, heating and other operations affect the relative economy of the various concrete mixes, conclusions may be drawn from the foregoing facts and figures.

1. At sub-normal air temperature,

TABLE III — CONCRETE COSTS AT VARIOUS TIME VALUES FOR THREE MIXES OF STANDARD PORTLAND AND HIGH-EARLY-STRENGTH CEMENT CONCRETE DEPOSITED AT 70 DEG. CONCRETE AND 50 DEG. AIR TEMPERATURES

Water ratio	Days heat per floor	Days for 2,000 lb. per sq. in.	Const. time, work days	Cement cost, 1,300 cu. yd.	Heat cost, seven floors	Total cost for daily time value of $25	$50	$100
			Ordinary Portland Cement					
5 gal.	1¼	5	66	$5,070	....	$6,720	$8,370	$11,670
	1	3	51	5,070	$350	6,695	7,970	10,520
6 gal.	¾	14	96	4,160	....	6,560	8,960	13,760
	1	5	66	4,160	350	6,160	7,810	11,110
	3	3	51	4,160	1,050	6,485	7,760	10,310
7 gal.	¾	28	156	3,510	....	7,410	11,310	19,110
	1	14	96	3,510	350	6,260	8,660	13,460
	3	10	81	3,510	1,050	6,585	8,610	12,660
			24-Hour Cement					
5 gal.	1¼	2	46	6,338	....	7,488	8,638	10,938
	¾	¾	42	6,338	280	7,668	8,718	10,818
6 gal.	1¼	3	51	5,200	....	6,475	7,750	10,300
	1	1	42	5,200	350	6,600	7,650	9,750
7 gal.	1¼	5	66	4,388	....	6,038	7,688	10,988
	1	2	46	4,388	350	5,888	7,038	9,338

TABLE IV — CONCRETE COSTS AT VARIOUS TIME VALUES FOR THREE MIXES OF STANDARD PORTLAND AND HIGH-EARLY-STRENGTH CEMENT CONCRETE DEPOSITED AT 50 DEG. CONCRETE TEMPERATURE AND 50 DEG. AIR TEMPERATURE

Water ratio	Days for 2,000 lb. per sq. in.	Const. time, work days	Cement cost 1,300 cu. yd.	Total cost for daily time value of $25	$50	$100
		Ordinary Portland Cement				
5 gal.	7	66	$5,070	$6,720	$8,370	$11,670
6 gal.	14	96	4,160	6,560	8,960	13,760
7 gal.	28	156	3,510	7,410	11,310	19,110
		24-Hour Cement				
5 gal.	2	46	6,338	7,488	8,638	10,938
6 gal.	3	51	5,200	6,475	7,750	10,300
7 gal.	7	66	4,388	6,038	7,688	10,988

TABLE V — CONCRETE COST AT VARIOUS TIME VALUES OF STANDARD PORTLAND AND HIGH-EARLY-STRENGTH CEMENT CONCRETE DEPOSITED AT 20 DEG. AIR TEMPERATURE

Water ratio	Days heat per floor	Days for 2,000 lb. per sq. in.	Const. time, work days	Cement cost, 1,300 cu. yd.	Heat cost, seven floors	Total cost for daily time value of $25	$50	$100
			Ordinary Portland Cement					
5 gal.	1	10	81	$5,070	$525	$7,620	$9,645	$13,695
	2¼	3	51	5,070	1,330	7,675	8,950	11,500
6 gal.	3	3	51	4,160	1,575	7,010	8,285	10,835
			24-Hour Cement					
5 gal.	¾	1	42	6,338	525	7,913	8,963	11,063
6 gal.	1	1	42	5,200	525	6,775	7,825	9,925
7 gal.	1	3	51	4,388	525	6,188	7,463	10,013
	2	2	46	4,388	1,050	6,588	7,738	10,038

TABLE VI — COST OF CONCRETE AT VARIOUS TIME VALUES WHEN USING ONE AND TWO SETS OF FORMS, AT 20 DEG. AIR TEMPERATURE

Water ratio	Days heat per floor	Days for 2,000 lb. per sq. in.	Const. time, work days	Cement cost, 1,300 cu. yd.	Heat cost, seven floors	Cost forms	Total cost for daily time value of $25	$50	$100
			Ordinary Portland Cement						
			(One form set;						
5 gal.	1	10	81	$5,070	$525	$2,560	$10,120	$12,145	$16,195
			(Two form sets;						
5 gal.	1	10	44	5,070	525	5,000	11,695	12,795	14,995
			24-Hour Cement						
			(One form set;						
6 gal.	1	1	42	5,200	525	2,500	9,275	10,325	12,425

it pays to maintain concrete temperatures at 70 deg.

2. For air temperatures of 50 deg. or lower, savings in time and heat protection result from the use of 24-hour cement on light construction like buildings. At higher temperatures, and for mass work, ordinary portland cement will frequently show a favorable cost comparison.

3. With low time values and mild temperatures, a leaner mix and minimum heat protection will usually show a profit; but as time values increase and temperatures approach freezing, it is best to use sufficient heat and a mix which will produce service strength within a short time.

These conclusions refer particularly to concrete frame construction, but the same principles apply in degree to the entire range of concrete work. They are borne out by observation of winter jobs, including not only buildings, but bridges, precast products, sewers, watertight and other structures.

How to lower costs

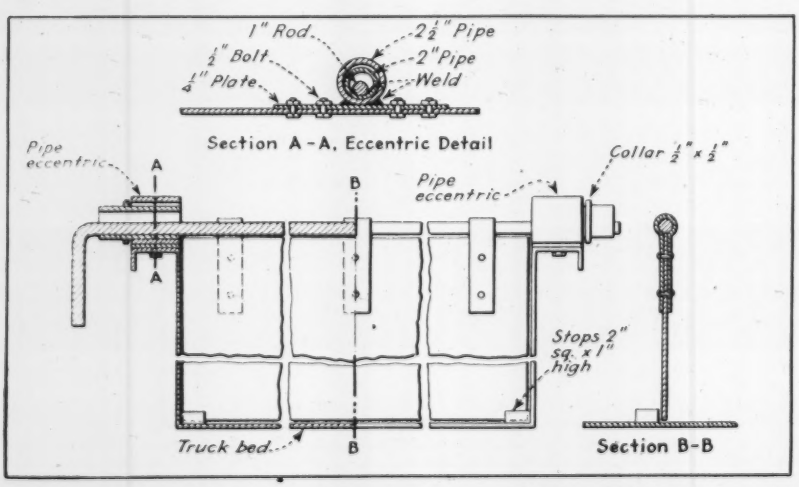
The way to lower costs and shorten construction time is frequently found by a simple calculation following lines of the example. The common assumption that available means for protecting concrete from cold are to be used only as a last resort against freezing needs to be revised. It may have been somewhat justified in an earlier period of concreting technique, but means of combatting cold by heating and with special cements have completely changed the construction picture. Heat protection is not now merely a safeguard against structural damage; it is an economic measure for reducing concrete construction costs to be considered in estimating winter work quite as carefully as are other methods and equipment terms.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Simple Swinging Partition For Truck Body

Concrete aggregate for the 150 structures on the 59-mile Casper Canal of the Kendrick Project of the U. S. Bureau of Reclamation, taking water from the Alcova Reservoir to 35,000 acres of land to be irrigated east of Casper, Wyo., had to be hauled in 7- and 10-cu. ft. weighed batches. Contractors holding the hauling contracts were required to use end-dump trucks to which swinging partitions could be attached. The bodies were required to be 9 or 7 ft. long and 5½ ft. wide; these sizes gave five and four batch-compartments, respectively. Hinged supports for the ¼-in. sheet steel partitions were 1-in. rods housed in eccentric bearings bolted to the top of the truck sides. The 1-in. rod was bent at right angles to form a handle which when turned lifted the partition to clear a 2-in. square head of a stud bolt screwed into the body floor at the rear of the swinging partition. The eccentric bearing was a piece of 2½-in. pipe welded to a ¼-in. plate bolted to the truck top. The eccentric was formed from a section of 2-in. pipe through which the 1-in. rod was threaded and welded. Wedges were welded into the rear corners of the body to restrict the opening so that the material would slide into the skip of the 7- and 10-cu.ft. mixers used. This detail of the partitions was devised by I. F. Matthews, resident engineer of the canal division of the Kendrick (formerly Casper Alcova) Irrigation Project.



Swinging steel partition for attachment to end-dump truck bodies.

• • •

Computing Properties of Rivet Groups

by THEODORE DOLL

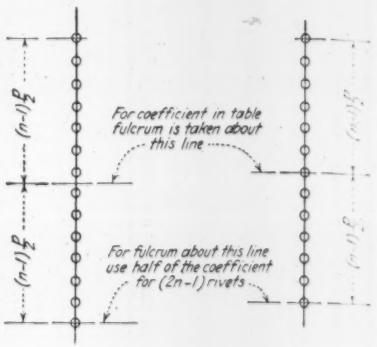
C. M. St. P. & P. R. R., Chicago, Ill.

The accompanying table, because of its simplicity and adaptability, has been found useful for computing the section modulus and moment of inertia of a group of rivets; for example, in the design of plate girders, web splices and brackets.

The number of rivets in a single line is given in the *n* column. To find the section modulus of the rivets about the centroid of the line, multiply the coefficient *S* by the rivet pitch; to find the moment of inertia, multiply the coefficient *J* by the square of the rivet pitch.

If the fulcrum is taken about the bottom rivet of the line, instead of about the centroid, as is sometimes assumed in the design of brackets, simply use one-half of the coefficient for (2*n*-1) rivets.

For a line of rivets containing unequal spaces, results close enough for practical purposes can ordinarily be obtained by using the average value of the rivet spacing as the pitch. A little experience will enable the designer to tell when this approximation may be used. Considerable discrepancy between the approximate and theoretically correct


(n-1)p
(n-1)p/2
For coefficient in table fulcrum is taken about this line
For fulcrum about this line use half of the coefficient for (2n-1) rivets

values is often permissible; for example, in computing the moment of inertia of the net section of a plate girder where the holes out of the web are only a small fraction of the total section; or computing the rivet stress in a case where most of the stress is caused by shear instead of moment.

The table is also useful for computing the polar section modulus of a group of several parallel lines of rivets, as in the case of a shallow web splice. After the moment of inertia of each line has been found in the manner already described, it is only necessary to add to the sum of these values the product of the number of rivets in each line by the square of the distance of the line from the gravity axis of the group.

For cases beyond that limit of the table, the coefficients may be computed from the following formulas: $S = (n/6)\ (n—1)$ and $J = (n/12)\ (n^2—1)$.

Table for Computing Properties of Rivet Groups

n	*S*	*J*	*n*	*S*	*J*
2	1	0.5	26	117	1462
3	2	2	27	126	1638
4	3⅓	5	28	135⅓	1827
5	5	10	29	145	2030
6	7	17½	30	155	2248
7	9⅓	28	31	165⅓	2480
8	12	42	32	176	2728
9	15	60	33	187	2992
10	18⅓	82½	34	198⅓	3272
11	22	110	35	210	3571
12	26	143	36	222	3885
13	30⅓	182	37	234⅓	4218
14	35	227½	38	247	4570
15	40	280	39	260	4940
16	45⅓	340	40	273⅓	5330
17	51	408	41	287	5740
18	57	484½	42	301	6170
19	63⅓	570	43	315⅓	6622
20	70	665	44	330	7095
21	77	770	45	345	7590
22	84⅓	885½	46	360⅓	8108
23	92	1012	47	376	8648
24	100	1150	48	392	9212
25	108⅓	1300	49	408⅓	9800
			50	425	10412

CAMERA MEMORANDA OF CONSTRUCTION AIDS

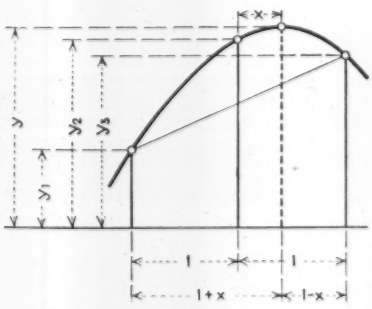
1—On a state and federal grade-separation job in Buffalo, N. Y., the John W. Cowper Co., contractor of that city, is building all forms on the viaduct deck 60 ft. above ground. A valuable aid in the work is a small gasoline-engine generating set which supplies power to an electric saw as shown by the illustration.

2—The same contractor saves 2x8-in. runway plank waste by capping the plank ends with ½x2-in. strap iron. The strap covers the end and 6 in. of each edge of the plank; is is nailed in place. This armoring identifies runway plank, keeps the ends from splitting and discourages carpenters from sawing off short pieces.

Finding Curve Ordinates

by CHARLES E. SHARP, JR.
University City, Mo.

The exact method of finding maximum or minimum ordinates to a given curve is applicable in engineering practice only when the curve's equation is simple and easily differentiated. When the equation is unknown, unwieldy or impossible to differentiate, a second method is to draw a smooth curve through several known ordinates, then find the desired peak by observation.



For the latter case, the writer proposes the following method, as being more satisfactory. It is to assume a parabola passed through three known points, equally spaced. If the points are reasonably close, so that no local bumps or reversals occur in their region, then the peak of the parabola should approximate very closely and be used for that of the given curve. The co-ordinates for this peak are:

$$x = \frac{y_3 - y_1}{4\left(y_2 - \frac{y_1 + y_3}{2}\right)}$$

$$y = y_2 + \frac{(y_3 - y^1)^2}{16\left(y_2 - \frac{y_1 + y_3}{2}\right)}$$

Note: x is a ratio and
a is the actual ordinate

• • •

Brief Memorandum

The New Mexico State Highway Laboratory makes use of the Page impact machine for testing the cementing value of clay binders used in gravel road construction.

The impact tester as furnished however had no automatic shut-off and the machine had to be stopped by the operator when the specimen failed. An effective automatic shut-off switch has been designed and installed by the testing engineer.

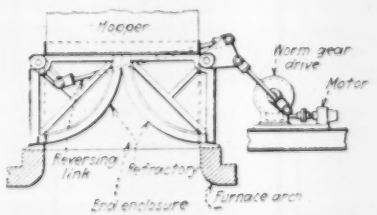
The plunger, which rests on the specimen, is fitted with a short arm to operate a sensitive push-button type switch secured to the plunger housing. As soon as the specimen fails, the arm on the plunger trips the switch and stops the machine.

Another addition to this machine is a Veeder revolution counter, which was installed in place of the equipment furnished for measuring the number of impacts. The counter is fastened to the end of the eccentric shaft and is supported by a frame built out from the gear housing.—B. E. Rutz, *Testing Engineer, Bureau of Materials, New Mexico State Highway Department, Las Cruces, N. M.*

• • •

Gate for Refuse Furnaces

A new type of electrically-operated charging gate for refuse incinerators is in use in one of New York's incinerator plants. The elimination of seat and other castings, which ordinarily come within range of the radiant heat of the furnaces and which usually contribute to high maintenance costs, is apparent from the sketch. The adjustment of the gates is simple and convenient for the operator, and because of the light weight, they are easily removed for repair and replacement. Push button control stations are within reach of the firemen and the dump-floor laboarer who may share the operation of the gates. The refractory facing is replacable by merely rotating the gate away from the hopper.



Electrically operated charging gate for refuse furnaces.

THE WEEK'S EVENTS

Continued from page 773

Substitute Wage Bill Is Possible

Washington Correspondence

In view of the opposition of Northern industry and the lukewarm attitude of the American Federation of Labor toward the discretionary powers granted in the Black-Connery labor standards bill, Senator Berry's wage hour bill assumes definite importance. The bill provides for a statutory 40-hour maximum work week and a 30- or 35-cent minimum wage. No administration board would be appointed, and the law would be enforced by the Department of Justice.

It is remotely possible this bill has the approval or the sponsorship of the President. It may have been the subject of Matthew Woll's recent conference at Hyde Park. It isn't the kind of bill President Roosevelt wanted, but the Black-Connery bill is now faced with strong opposition from so many directions that the President is undoubtedly thinking compromise. Washington labor observers think that Jackson and Corcoran and Cohen have been working up something new in wages-hours for some time.

It is suspected also that the American Federation of Labor is interested. AFL officials say they will "consider any new wages-hours proposal carefully before making a decision." The new bill puts the government definitely out of the bargaining field.

CIO has refused for months to comment on wages-hours. They refer all inquiries to Labor's Nonpartisan League, of which Senator Berry was formerly head. Senator Berry is friendly to both big unions. He is head of the International Pressmen's Union, which seriously considered going over to CIO but stayed with AFL.

Washington representatives of southern industry say they are sure it will not support the 30-cent minimum. They say even that figure is far more than wages paid to large numbers of colored and low-scale white workers. The bill will undoubtedly be opposed by the South.

It appears likely that Berry's bill would largely remove Northern industrial opposition arising from the arbitrary power of the proposed board; that it will win over organized labor from its non-commital attitude, and that such a combination might beat the South.

The Berry bill of course would be introduced in both House and Senate as a substitute for the Black-Connery bill passed by the Senate and now stalled in the House rules committee. Senator Thomas of Utah, successor to Senator Black as chairman of the Senate Education and Labor Committee, is a strong labor man, probably would resent the more conservative bill, but would support the administration.

If the amount of unemployment, disclosed by returns from the unemployment census, should be large it would give impetus to wages and hours legislation on the assumption that it would spread work. Some are of the opinion that the census will disclose that the unemployed number more than 10,000,000 rather than less that that amount regardless of what these returns may show they are expected to have an important bearing on what Congress does in the way of wages and hours legislation.

• • •

Better Building Figures To Be Meeting Subject

An open meeting of the Construction League of the United States, to be held in Washington the afternoon of Nov. 18, will be devoted to a presentation of the need of prompt and accurate statistics concerning the various categories of construction. The open meeting will be preceded in the morning by a meeting of the members of the General Assembly of the League.

Lowell J. Chawner of the Department of Commerce will present "A Statistical Program for the Construction Industry." The need of better construction industry statistics for federal planning will be told by Charles W. Eliot, 3rd, executive officer of the National Resources Committee; for state planning, by Otto T. Mallery of the Pennsylvania state planning board; for city planning, by Frederick Bigger, director of the Municipal Planning Association, Pittsburgh; for public utilities and industry, by Malcolm Pirnie, past president of the American Water Works Association; for contractors, by W. A. Klinger, president of the Associated General Contractors of America; for material producers, by Russell G. Greviston, president of the Producers' Council.

Bonneville Rate Base Nearer Decision

Washington Correspondence

Although it will be some time before a definite kilowatt-hour rate can be announced for surplus power from the newly-completed Bonneville Dam on the Columbia River, recent developments have materially clarified the future course of the federal government in marketing energy—not only in the Pacific Northwest, but also in other regions in which there are "yardstick" power projects. (*ENR*, Aug. 19, 1937, p. 287)

Most important of the recent developments is the establishment of a basic policy for rate-making, by which the United States will receive 3½% interest on the amount of money tied up in power development, plus amortization spread over a 40-year period, in addition to the actual operating costs. This formula has been approved by President Roosevelt as respects Bonneville, and it is strongly hinted that it will also be applied to other federal projects, such as Boulder Dam and the Tennessee Valley developments.

While this announcement is a long step forward in crystallizing the administration's power policy, it still leaves unanswered two questions that must be determined before the Bonneville rate can be announced. J. D. Ross, recently appointed administrator for the project, points out that the federal Power Commission has still to decide how much of the project's $51,000,000 cost should be charged to power, and the administrator must then decide over what output to spread his annual costs.

The second question arises from the fact that Bonneville, like most federal power projects, is being built by stages. The present installation consists of two 43,000-kw. generators; ultimately there will be ten such units. Mr. Ross points out that a calculation based upon the initial capacity only would load the rate with an unduly heavy proportion of the cost of the huge dam, perhaps to such an extent that load-building activities would be seriously hampered.

In regard to his immediate plans for marketing Bonneville power, Mr. Ross declares that he will adapt his plans to conform to the demand for service, and this will not be known until a rate basis is announced. So far the only formal customer to sign up has been the town of North Bonneville, close to the dam. Although many other municipalities, public power districts and even privately-owned utility companies have expressed interest in procuring some of his power, all such negotiations are still tentative.

The Bonneville Act requires that preference be given to public power distributors in the allocation of the plant's output, even to the extent of a five-year cancellation clause in contracts with private utilities, but Mr. Ross does not think that this should cause any concern. "There will be plenty of power for all demands," he says, "for many years to come. We would be foolish to discontinue service until the full capacity of the ultimate plant is utilized."

One of the immediate problems to be met will be the construction of transmission lines to take the power from Bonneville to its customers, which will all be either large-scale industrial users or distributors to the ultimate consumer, since the administrator has no power to sell directly to individuals. No funds are now available for this purpose, but it is anticipated that Congress will soon be asked for an appropriation. How much will be needed is still undetermined, and will depend largely upon the number and location of interested inquirers for immediate service.

• • •

Yarnall Elected President Of Engineering Trustees

D. Robert Yarnall, chief engineer of the Yarnall-Waring Co. of Philadelphia, has been elected president of United Engineering Trustees, a joint agency of the four founder societies. He succeeds George L. Knight, vice-president of the Brooklyn Edison Co.

United Engineering Trustees, founded in 1904, administers for the founder societies properties valued at $4,000,000, consisting of the Engineering Societies Building, the Engineering Societies Library, and endowment funds which the corporation holds jointly for the four societies. Through the Engineering Foundation, the Library Board, and the administrative department, the trustees aid research in engineering and the sciences, operate the library, and carry on many other activities in behalf of the profession.

New vice-presidents of the organization are Albert Roberts, secretary of the Minerals Separation North America Corp., New York, and Henry A. Lardner of the J. G. White Engineering Corp., New York. H. R. Woodrow, vice-president of the Consolidated Edison Co. of New York, becomes treasurer and J. P. H. Perry, vice-president of the Turner Construction Co., assistant treasurer.

Trustees elected by the American Society of Civil Engineers are J. P. H. Perry; Col. John P. Hogan, chief engineer of the New York World's Fair of 1939, and Otis E. Hovey, New York consulting engineer.

Bridge Maintenance Discussed By Railway Engineers

American Railway Bridge and Building Association holds annual meeting at Chicago.

Maintenance work on railway bridges and trestles was a prominent subject at the annual meeting of the American Railway Bridge and Building Association, held recently at Chicago. Of particular interest were reports on the maintenance of movable bridges, improvements in trestle construction, and the effect of deferred maintenance. In movable bridge maintenance, little trouble is experienced with the mechanism, except in cases where gears, racks or rollers are of inferior quality. Typical cases of maintenance work were the renewal of the bearing disk of a swing span, the correction of tread and rollers of a rim-bearing swing span, and the renewal of trunnion bushings on a bascule span.

Improvements in timber trestles were reviewed in a report which dealt mainly with a variety of construction details, such as the fastenings of stringers to caps and caps to piles. Steel caps have been introduced in some designs; on the Louisiana and Texas Lines of the Southern Pacific System, they are composed of pairs of H-beams with top and bottom cover plates, while the Northern Pacific uses a single 12-in. H-beam with plates welded between the flanges as stiffeners over the piles and under the stringers. A good part of this report dealt with the use of treated timber, and the pre-framing and pre-boring of such timber. The former is generally considered practicable, but there is difference of opinion as to the extent to which pre-boring can be done successfully. Some railroads have modified their trestle designs to facilitate pre-framing and to effect improvements in details, especially the connections.

As to fire protection, it was stated in a report that covering open decks with sheet metal has been found objectionable because of the cost of maintenance and the difficulty of making proper inspection; in addition, this covering is an obstruction to the extinguishing of fires starting under the deck. Fire-retardent paint has not been successful on creosoted timber, as the leaching out of the oil breaks the paint coat. A heavy coating of sand will form a protection for a short time. On untreated floors, a heavy coat of paint on which sand is spread while the paint is wet is a good protection. But ballasted deck construction eliminates almost all hazard of fire from the top of the structure.

Costly and uneconomical results of deferred maintenance in painting programs were reviewed in another report. Thus, neglect of painting over a term of years necessitated the replacement of some 580 tons of steel at a cost of $47,000, while proper painting during that term would have cost only about $27,000. In another case, neglect of painting necessitated renewal of an entire structure at a cost of $18,500, while an adequate painting program would have cost 50 per cent less. The same condition applies to shops and engine terminals. In a case where renewal of woodwork cost $1,300, the interest on that sum would have paid for annual painting to prevent decay.

Water supply stations are feeling the results of the practice of using larger tenders and making longer runs without changing engines. In certain cases the tank capacity has become insufficient, as engines making longer runs pass intermediate water stations and concentrate at certain stations where they replenish tender tanks of 20,000 to 23,000 gallons capacity. Furthermore, on the long runs it is desirable to have the water supplies as uniform in quality as possible, and this may call for refinements or changes in water treatment methods. In pump equipment, the trend is to oil engines or electric motors, with horizontal centrifugal pumps or deep-well turbine pumps. Track tanks are used mainly on eastern railroads, which have about a hundred installations in heavy-traffic districts. In view of the high cost of operation and maintenance of such installations, the report concluded that large tenders would be more satisfactory and economical, as the increased capacity makes it practical to reduce the number of stops for water.

• • •

Queens Opens Asphalt Plant

Described as "the largest and most modern of its kind ever built by an American municipality," a new $900,000 asphalt plant has been opened by the Borough of Queens, New York City. The new plant occupies a 5½-acre site on the Flushing River, and replaces a smaller plant which had to be removed to make room for the world's fair grounds.

PERSONAL

IVAN E. OAKES has been appointed deputy WPA administrator for Oregon succeeding John C. Albright.

JOHN C. ALBRIGHT has resigned his position as deputy WPA administrator for Oregon to join the staff of the Union Pacific Railroad.

C. C. COBB, former assistant to Captain Mielenz, has been put in charge of the dredging section of the Memphis Engineer District.

TRACEY W. CAHOW has been appointed assistant engineering draftsman at the Denver office of the Bureau of Reclamation.

FRANCIS T. HAYDEN has been appointed an engineering draftsman in the Heart Mountain division of the Bureau of Reclamation.

REAR ADM. NORMAN M. SMITH, Civil Engineer Corps, U. S. Navy, has requested retirement from his position as chief of the Bureau of Docks and Yards.

HOWARD S. HATCH, for 29 years assistant engineer of Middlesex county, Mass., has been appointed county engineer, succeeding the late Francis H. Kendall.

CAPT. L. E. MIELENZ will succeed Captain Wilson as executive officer of the U. S. Engineer District at Memphis. Captain Mielenz has been in charge of the dredging section.

J. WENTWORTH LEWIS, a member of the engineering staff of the Canadian Pacific Railroad at Woodstock, N. B., has been made general manager of the American Concrete Corp. in Chicago.

W. COMPTON WILLS, chief engineer since 1932 of the Wilmington, Del., water department, has been appointed manager and chief engineer of the department.

JOHN MORSE, for a number of years general superintendent of the Shawinigan Water & Power Co. and previously on the engineering staff, has been appointed assistant general manager.

P. S. GREGORY, member of the engineering staff of the Shawinigan Water & Power Co., has been appointed to the newly created executive post of assistant general manager.

A. P. GARDINER, formerly junior engineer with the Bureau of Reclamation at Denver, has joined the bridge designing division of the Washington state highway department.

CAPT. F. J. WILSON, who has been executive officer of the Memphis engineer district, has been given a special assignment supervising the $16,000,000 program of levee construction work on the upper St. Francis River.

ROBERT F. HERDMAN who has been resident engineer for the Bureau of Reclamation at the Bartlett dam, has been transferred to the position of engineer at the Denver office of the bureau.

G. C. WENDLING, since 1934 division engineer of the Louisville & Nashville Railroad, has been appointed superintendent of the Montgomery and Nashville division of the road, succeeding the late J. A. MORRISON.

HENRY C. ANDERSON, professor of mechanical engineering at the University of Michigan and a member of the faculty there since 1900, has been appointed dean of the college of engineering, succeeding Prof. Herbert C. Sadler.

HARRY A. HOPKINS has been appointed asistant director of public works of California. Mr. Hopkins has for a number of years been a member of the state highway commission and has recently been chairman of the commission.

J. B. CHALLIES, manager of the water resources department of the Shawinigan Water & Power Co. and formerly connected with the Dominion Water Power Bureau at Ottawa, has been appointed assistant general manager of the company.

COMDR. BEN MOREELL of the navy civil engineer corps has been appointed chief of the Bureau of Docks and Yards, effective Dec. 1, with the rank of rear-admiral. Commander Moreell is now stationed at Pearl Harbor as public works officer of the 14th naval district.

M. L. O'NEALE, state engineer and more recently state director of the PWA program in West Virginia since 1933, has retired from this position and has become general manager of Hugh Miller Associates, consulting firm with headquarters at Charleston, W. Va.

LLOYD A. WOODWARD has been appointed county engineer of Gage county, Nebr., succeeding H. J. Shaw, resigned. Mr. Woodward, a graduate of the University of Nebraska engineering college, has recently been WPA divisional engineer for 17 southeastern Nebraska counties.

A. J. ACKERMAN, who recently resigned his position as head construction plant engineer for the Tennessee Valley Authority, has been appointed development engineer for the engineering works division and the contracting division of Dravo Corp. of Pittsburgh. Mr. Ackerman, a graduate of the University of Wisconsin in the electrical and civil engineering departments, has previously been associated with Stone & Webster on the Conowingo dam and with W. E. Callahan Construction Co. on the Madden Dam at Panama.

R. M. LEEDS has been appointed division engineer of the Louisville & Nashville R.R. succeeding G. C. Wendling. Mr. Leeds has been assistant division engineer at Louisville. He is a graduate of Rose Polytechnic Institute and has been connected with the Louisville & Nashville R.R. for about 25 years.

HOWARD R. GRAY who has been head of the Housing Division of PWA, has been appointed to the post of deputy administrator of PWA which was recently vacated by the resignation of Horatio B. Hackett. It is expected that the functions of the housing division will be taken over by the new U. S. Housing Authority.

OLIVER F. ALLEN has resigned his position with PWA in New York to devote more time to his consulting practice, especially in reference to diesel engines, power plants, and international engineering and production liaison. He continues as managing director of Martin Motors, Inc., and secretary and director of American Rezo, Inc.

GEORGE S. SUMMERELL has been appointed district engineer for the Cleveland Clay League. A former building commissioner of Cleveland and a consultant on state and municipal building code legislation, Mr. Summerell has recently been district manager of the Brick Manufacturers Association in St. Louis and in California. In his new position he will have charge of consulting work with architects, engineers, contractors and building officials on brick masonry construction.

• • •

Municipal Power Upheld By Court Decision

Federal Judge Martin has denied an application by the West Tennessee Power & Light Co., for an injunction preventing the City of Jackson, Tenn., from contesting a municipal electric distribution system to distribute TVA power. The power company had contended that it had an exclusive franchise privilege granted by the city in 1913 and good until 1963.

The court decision held that the 1913 franchise was invalid, because a 1909 act of the state legislature, which gave the city authority to provide for lighting and heating of the city, specifically stated that "no exclusive right or franchise in the streets and avenues shall be granted to any person, firm or corporation."

C. of C. Conference Program Identical Cement Bids

The Chamber of Commerce has announced the program for its conference on the stimulation of local residential construction which is to be held in Washington Nov. 17-18. The Construction League of the United States, the Producers Council and the directors of the American Institute of Architects will meet in Washington during the same week.

It is planned to devote the morning of the first day to a study of municipal problems under the chairmanship of William S. Parker, general chairman of the Construction League of the United States. Speakers will include Lowell J. Chawner, chief of the construction economic section of the Department of Commerce, speaking on residential facts and figures; Walter R. McCornack, chairman of the small house committee of the American Institute of Architects, speaking of obsolete municipal codes; and Harland Bartholomew of St. Louis, who will discuss the relation of neighborhood protection to residential building.

A luncheon discussion of residential financing will be under the chairmanship of Samuel F. Clabaugh, president of the Protective Life Insurance Co., and A. P. Greensfelder, chairman of the construction and civic development committee of the Chamber of Commerce, will be chairman of the residential construction discussion in the afternoon. At this session, opportunities for building rental properties will be discussed from the point of view of the investor by Charles F. Lewis, director of the Buhl Foundation, and from the point of view of government by Stewart McDonald, administrator of FHA.

The second morning will be devoted to "Merchandising Houses" under the chairmanship of Ernest C. Trigg, president of the National Paint, Varnish and Lacquer Association, and will include discussion of plans to stimulate the market for small house construction by representatives of several building products associations and a discussion of real estate taxation by John C. McMowbray, chairman of the housing committee of the National Association of Real Estate Boards.

In the afternoon, William A. Klinger, president of the Associated General Contractors, will be chairman of a study of local group servicing. Nathan Straus, administrator of the U. S. Housing Authority will speak on the Wagner-Steagall housing act and Howard W. Green, director of the real property inventory of metropolitan Cleveland, will present a paper on "How to determine need for housing."

OBITUARY

ROBERT A. CARNAHAN, former resident engineer for the Ohio state highway department in Jefferson County, died Oct. 20 at Tucson, Ariz.

SAMUEL A. BERG, who for the past five years has been in charge of construction of several schools and hospitals in Alaska for the government, died in Seattle Oct. 20. Before his Alaskan work, Mr. Berg was for many years associated with A. W. Quist & Co. and also with the Ward Construction Co. of Seattle.

JOHN V. SCHAEFER, president of the J. V. Schaefer Construction Corp., New York City, and formerly city engineer of Long Beach, L. I., died Oct. 21 at the age of 65. Mr. Schaefer's firm had built about 50 schools in Westchester county, the Rockefeller Hall at Cornell University, and a number of libraries and private houses.

HAMILTON J. CHAPMAN, chief consulting engineer on the Grand Central Terminal at New York and for many years active in consulting practice on building construction in the East, including the Flatiron Building in New York, and the Treasury Building Annex in Washington, died at Franklin, Mass., Oct. 24 at the age of 73. Mr. Chapman was a graduate of Worcester Polytechnic Institute in 1886.

L. B. CHEMINANT, office engineer for the public works commission at San Francisco, died there Oct. 23 at the age of 59. Mr. Cheminant had been in the employ of the city since 1908 and was associated with the late M. M. O'Shaughnessy throughout the entire period of construction of the Hetch Hetchy water supply project. He was resident engineer and then for a number of years manager of the Hetch Hetchy R.R. and as the project neared completion he was stationed at San Francisco as office engineer, devoting much time to writing and lecturing on the project. He was a graduate of the University of California in 1900.

• • •

Identical Cement Bids Studied in Texas

The Texas State Senate, in the course of a special legislative session, passed a resolution setting up a committee to investigate identical bids on cement received by the Texas Highway Commission with a view to determining whether the Texas anti-trust laws have been violated.

Big Bridge Planned In Manila

The Philippine government has approved loans totaling $700,000 for a bridge across the Pasig River in Manila. Of this $245,000 will be for the substructure, $290,000 for the superstructure, and $165,000 for the approaches. Bids for construction of the substructure were opened Sept. 20. Construction of the bridge will be financed entirely by loans from the Philippine government, which will be reimbursed from tolls to be collected from motor vehicles using the bridge.

The bridge, which is expected to take about two years to complete, will have the longest single span and the greatest width of any bridge constructed in the Philippines and will be the first bridge to cross the Pasig River with a single span. It will consist of a 396 ft. steel arch, consisting of three parallel ribs with a rise of 54 ft. The bridge will carry two 30-ft. roadways providing three lanes of vehicle traffic in each direction and there will be a 6-ft. sidewalk on each side of the bridge.

• • •

Engineering Contract Let For Brazos Project

Contract for design and engineering services on the proposed $4,500,000 Possum Kingdom dam, which is to be a unit of the Brazos River conservation and reclamation district project, has been awarded to the Ambursen Engineering Co. of New York City by the board of directors of the district. The board also announced a contract with the Ambursen Co. for engineering services on the 12 other dams to be built in the Brazos River project within the next five years.

• • •

Prequalification Required In Indiana

The Indiana Highway Department has drawn attention of contractors to the fact that a law passed by the recent session of the legislature requires contractors intending to bid on Indiana road projects to submit advance qualifications covering financial status, experience, and equipment. This information, which replaces the former financial statement, must be submitted 30 days before bids are opened. Pre-qualification forms are furnished by the highway commission.

The warning to contractors was made on the occasion of announcing that bids on $500,000 of work will be taken December 7.

Power Lines Not Liable For Telephone Trouble

The Arkansas State Utilities Commission ruled in a recent decision that a power company building lines in the state along a public road is not responsible for electrical interference with telephone lines along the road, even though the telephone lines were built before the power lines.

The case arose in connection with the State Forestry Commission's attempt to intervene in an application of the Arkansas Power & Light Co. to construct rural electric lines along the public highways in Grant and Hot Spring counties. The forestry commission has telephone lines along the road which are used for fire fighting purposes. The forestry commission held that construction of the company's lines would set up inductive interference which would render 60½ miles of the telephone lines useless. The telephone lines are of the single wire grounded type.

The power commission, in its decision, said that "the forestry commission and the power company under the laws of this state may construct their lines on the state highway right-of-way without payment to the state. The induction from the power line to the telephone line injures in no manner the telephone property of the State Forestry Commission but does interfere with its use.

"The department takes the position that if there is no physical damage or property injury, priority of construction should not influence its decision."

• • •

Buffalo Disposal Plant Contract Awarded

The last major item in the $15,000,000 sewer project at Buffalo, N. Y. was put under way Oct. 28 with the award of contract for the erection of the main building of the sewage disposal plant on Bird Island to Couse & Saunders, Detroit, on their low bid of $565,000.

• • •

Safety Council Named In Maryland

A number of engineers are included among the 35 members recently appointed to the newly formed Maryland Highway Safety Council by Governor Nice of Maryland. The council, which will approach the problem of planning to reduce traffic accidents from the engineering, educational and law enforcement sides, will be under the chairmanship of Dr. S. S. Steinberg, dean of the College of Engineering of the University of Maryland.

Included in the membership are Clarence Taylor, director, Highway Planning Survey; Homer Tabler, chairman, Maryland State Roads Commission; Nathan L. Smith, chief engineer, Maryland State Roads Commission, Wallace Braun, traffic engineer, Baltimore Police Department; Henry G. Perring, engineer; Bernard L. Crozier, chief engineer of Baltimore; and Charles M. Upham, director, American Road Builders Association.

• • •

Road Bureau Lets Contract For Abingdon Station

Contract for the construction of buildings for the research station of the U. S. Bureau of Public Roads at Abingdon, Va., was awarded October 27 to the McCloskey Co., of Philadelphia on its low bid of $957,500.

Contract covers the construction of laboratory and shop buildings, the boiler house, mechanical and electrical equipment, and an alarm system. The buildings, of colonial design, will include in one wing facilities for bituminous and sub-grade soil researches, in the other wing structural tests and concrete investigations, and a center building will be used for a machine and carpenter shop, and as a garage.

• • •

Welding Laboratory Planned at Rensselaer

A gift of $20,000 has been made to Rensselaer Polytechnic Institute by George T. Horton, president of the Chicago Bridge & Iron Co. The gift will be used for the establishment of a new welding laboratory.

• • •

Muskingum District Levies Upheld by Court

Legal barriers which have been retarding completion of the Muskingum Watershed Conservancy District Project in Ohio were set aside Oct. 20 when the Ohio Supreme Court validated property assessments in the district. Appeals brought by 124 property owners from assessments against their property were dismissed by the court, which held that no constitutional question was involved. The assessments had previously been upheld in the lower courts.

Most of the property owners who protested were from the region around Marietta. They contended that the assessments against them were out of proportion to the benefits they would derive from flood protection.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

PORTLAND CEMENT ASSOCIATION, annual convention, Blackstone Hotel, Chicago, Nov. 29-Dec. 1.

AMERICAN STANDARDS ASSOCIATION, annual meeting, Astor Hotel, New York City, Dec. 1.

HIGHWAY RESEARCH BOARD, annual meeting, Washington, D. C., Dec. 1-3.

THE ASPHALT INSTITUTE, national asphalt conference, Memphis, Dec. 6-13.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS, annual meeting, Memphis, Dec. 6-11.

UNIVERSITY OF KENTUCKY, road and street school, Lexington, Ky., Dec. 6-9.

AMERICAN ROAD BUILDERS ASSOCIATION, road show and convention, Cleveland, Jan. 17-21.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York City, Jan. 19-21.

ENGINEERING INSTITUTE OF CANADA, annual meeting, London, Ont., Jan. 31-Feb. 1.

REGIONAL AND LOCAL

AMERICAN SOCIETY OF CIVIL ENGINEERS, IOWA SECTION, AND IOWA ENGINEERING SOCIETY, joint annual meeting, Ames, Iowa, Nov. 18.

IOWA STATE COLLEGE, annual highway safety conference, Ames, Nov. 18-20.

NEW JERSEY ASSOCIATION OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS, Elks Club, Jersey City, N. J., Jan. 14-15.

NEW YORK STATE SEWAGE WORKS ASSOCIATION, annual meeting, New York City, Jan. 20-22.

• • •

License Examinations

Iowa: Examinations for professional engineering Dec. 7-8 and for land surveying Dec. 9 at Des Moines.

• • •

Tenth Muskingum Dam Is Completed

Leesville Dam has been completed, the tenth to be finished of the fourteen dams in the program of the Muskingum Watershed Conservancy District. The dam is 1,695 ft. long and 62 ft. high. It was built at a cost of $500,000 by the Culbertson Construction Company at Cleveland.